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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 24A December 31, 1959

GENERAL

21817 BNL-554
Brookhaven National Lab., Upton, N. Y.
NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT [FOR] OCTOBER 1–DECEMBER 31, 1958. F. Maslan, ed. 71p. $2.00(OTS).

Work is reported on the mixing, fluidity, dissolution rates, fission product removal, corrosion, etc., of LMFR fuel. General activities reported on include reactor theory, experimental reactor physics, heat transfer, radiochemical technology, mechanical engineering, special radioisotope development, radiochemical analysis, and hot laboratory operations. (For preceding period see BNL-536.) (W.D.M.)

21818 NP-7914
Australia. Commonwealth X-Ray and Radium Lab., Melbourne.
ANNUAL REPORT FOR THE YEAR ENDED JUNE 30, 1958. D. J. Stevens. Jan. 1959. 21p.

Radium, radon, x ray, radioactive isotope, protection, and advisory services of the Laboratory are discussed and some statistical data are presented. (W.D.M.)

21819 SCTM-177-59(52)
Sandia Corp., Albuquerque, N. Mex.
RADIOSONDE OBSERVATIONS ANALYSIS OF SYSTEM AND PERSONAL ERRORS. Willette D. Lang. May 5, 1959. 34p. $1.00(OTS).

Radiosonde observations are subject to system and personal errors. The extent and effect of these errors upon the evaluation of the recorded data have not been fully appreciated. This study was made to show what may reasonably be expected, and that these errors can be of major importance. The special Radiosonde observation made at the Tonopah Test Range, December 15, 1958, was selected as a typical example of system and personal errors for this study. (auth)

21820 TID-3522(Rev. 2)
Technical Information Service Extension, AEC.
PEACEFUL USES OF NUCLEAR EXPLOSIONS. A Literature Search. Hugh E. Voress, comp. Sept. 1959. 6p. $0.50(OTS).

Uses covered in this literature search include production of isotopes, recovery of oils from sands and shales, formation of aquifers, production of power, mining operations, and harbor excavation. Fifty-four references are presented on reports and published literature to September 1959. (W.D.M.)

21821 CEA-tr-A-609
L'OBTENTION ET LA MESURE DE L'ULTRAVIDE. (Obtention and Measurement of Ultravacuum). F. A. Backer and J. Yarwood. Translated into French from Vakuum-Tech. 6, 147-53(1957). 24p.

Ultravacua (10^{-7} mm Hg) cannot be obtained with diffusion pumps because of the pump fluid. The inherent disadvantages in ion gages and flash-filament devices are discussed. Valves for ultravacua are discussed also. (T.R.H.)

21822
SHIPPING CASE FOR IRRADIATED FUEL ELEMENTS. A. Alonso Santos and A. Sevilla Benito. Energia nuclear (Madrid) 3, No. 10, 73-80(1959) Apr.-June. (In Spanish)

In the shipping of irradiated fuel elements special attention must be given to protection against radiation and to the elimination of the heat produced. The shipping case designed for the Junta de Energía Nuclear is described. It consists of an inner aluminum container in which are placed the fuel elements. The outer case is made of two steel cylinders with a lead shield between them. The tank has water pipes through it to remove the heat produced. The calculations to determine the thickness of the lead shield are given. (J.S.R.)

21823
ON ARTIFICIAL GEOMAGNETIC AND IONOSPHERIC STORMS ASSOCIATED WITH HIGH-ALTITUDE EXPLOSIONS. Sadami Matsushita (Univ. of Colorado, Climax). J. Geophys. Research 64, 1149-61(1959) Sept.

Geophysical effects of nuclear explosions at Johnston Island on August 1 and 12, 1958, were studied by means of IGY geomagnetic and ionospheric data collected at various stations in the Pacific area and the American continent. The explosion heights are estimated at 70 to 80 km and about 40 km, respectively. Immediately after each explosion, three phenomena occurred. Strong counterclockwise circular electric currents were formed in the vicinity of Johnston Island at 80- to 100-km height. They caused the immediate occurrence of artificial magnetic storms in the central Pacific. High-energy particles moving along the magnetic lines of force caused auroras seen from Apia, and also caused the main parts of the magnetic storms observed at Apia. X-rays due to the explosion caused the increase of the D-region absorption observed at Maui. Irregularities of the electron density in the F-layer at Maui and the maximum geomagnetic change at Honolulu were caused by a shock wave from the explosion. The degree

of ionization in a wide area in the central Pacific increased to about 10 times normal within 35 min after the first explosion and within about 6 hr after the second. Then a strong radio absorption continued for many hours. (auth)

21824

ATOMIC ENERGY PATENTS. HEARINGS BEFORE THE SUBCOMMITTEE ON LEGISLATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON ATOMIC ENERGY PATENTS, APRIL 21, 22, AND 23, 1959. Washington, D.C., Joint Committee on Atomic Energy, 1959. 233p. GPO.

Details of hearings by the Subcommittee on Legislation concerning atomic energy patents are presented. Testimony by Atomic Energy Commission personnel is given as well as that given by Dept. of Commerce personnel and other witnesses. Additional material supplied for the record is included. (J.R.D.)

21825

IMPROVEMENTS IN OR RELATING TO EVAPORATORS. Peter Waine and Derek Edmund Abel (to United Kingdom Atomic Energy Authority). British Patent 820,424. Sept. 23, 1959.

An evaporator arrangement is described. A liquid-gas cyclone separator is located above the boiler and returns liquid to the boiler. Boiler concentrate is removed through a valve controlled by return liquid strength. The concentration sensor utilizes a radioisotope gamma source and detector. (T.R.H.)

BIOLOGY AND MEDICINE

21826 AECU-4334

[Chicago. Univ.]

RADIOSENSITIVITY OF THE LYMPHOCYTE. [1959?]. 7p. Contract [AT(11-1)-144]. $1.80(ph), $1.80(mf) OTS.

Progress is reported in a study of the effects of whole-body x irradiation on lymphatic tissues. Quantitative measurements were made of the relation between changes in lymphatic tissue in the appendix of rabbits and the dose of whole-body x radiation administered. Data are tabulated. (C.H.)

21827 AECU-4350

Hawaii. Univ., Honolulu. Hawaii Marine Lab.

UPTAKE OF RADIOISOTOPES AND THEIR TRANSFER THROUGH FOOD CHAINS BY MARINE ORGANISMS. Annual Report 1958–1959. Sidney J. Townsley, Della F. Reid, and Winifred T. Ego. 47p. Contract AT(04-3)-56. $7.80(ph), $3.30(mf) OTS.

The development of a method for completely general interpretation of the results of radioactive tracer experiments with aquatic animals, independent of specific experimental conditions, is described. The application of this method for prediction of possible radiocontamination in known environmental conditions is discussed. Using euryhaline Tilapia mossambica, environmental and physiological factors have been investigated separately, in several ways, with the definite purpose of presenting an integrated picture of the metabolism of Ca^{2+} and Sr^{2+} in teleost fish. Results of preliminary tests, designed to determine which radioisotopes and organisms are best suited for the study of exchange of ions through food webs in the marine environment, are presented. (auth)

21828 AECU-4366

Wesleyan Univ., Middletown, Conn.

RESPIRATORY PATHWAYS IN FUNGI AND ACTINOMYCETES. Final Report [for] January 1, 1956 to June 30, 1959. Vincent W. Cochrane. Sept. 30, 1959. 29p. Contract AT(30-1)-1813. $4.80(ph), $2.70(mf) OTS.

Application of several methods to the problem of the balance of competing pathways in growing and non-growing spores of Fusarium solani leads to the hypothesis that growth (spore germination) is accompanied by a shift away from some pathway, presumably the phosphogluconate oxidative system, which yields an excess of carbon dioxide from carbon 1 of glucose. The respiratory system which takes its place distributes carbons 1 and 6 at equal rates into carbon dioxide and is probably the Embden-Meyerhof and Krebs cycle system. Preliminary data on Neurospora crassa conidia do not follow this pattern. Acetate metabolism by spores and mycelium is characterized by oxidative assimilation, exactly 50 per cent in F. solani, somewhat less in N. crassa. The distribution of acetate carbon in both species suggests operation of the Krebs cycle. Compounds related to acetate are, with some exceptions, only partially oxidized. The pattern of uranium inhibition of respiration of conidia of Neurospora sitophila is similar to that reported by Rothstein for yeast, i.e., an inhibition of glucose transport into the cell. Preliminary data on lipid synthesis and on the mode of action of cycloheximide are briefly described. (auth)

21829 AF-SAM-59-76

Tennessee. Univ., Oak Ridge. Agricultural Research Lab.

OBSERVATION OF LATENT EFFECTS FOLLOWING TOTAL-BODY GAMMA RADIATION IN THE BURRO. U. S. G. Kuhn, III, Roy E. Kyner, Daniel P. Sasmore, Daniel G. Brown, Fannie H. Cross, and Warren A. Gramly. Mar. 4, 1959. 9p.

The results of continued observation of burro survivors of sublethal doses of total-body gamma-ray irradiation are reported. Five deaths occurred during the observation period of this project, 3.6 years from November 1954 to May 1958. In four decedents, cause of death was associated with irradiation experience. The survivors seemed to make an early clinical and hematologic recovery and now appear to enjoy normal health and condition. Within two years after irradiation blood elements and weights were observed to be within values exhibited by nonirradiated controls. (auth)

21830 AMRNL-230

Army Medical Research and Nutrition Lab., Denver.

THE EFFECT OF DIETARY SUPPLEMENTS ON THE RADIOSENSITIVITY OF THE RAT. PART I. THE GROWTH OF IRRADIATED ANIMALS AND PAIR-FED CONTROLS. PART II. THE EFFECT OF DIETARY SUPPLEMENTS ON THE SURVIVAL OF IRRADIATED RATS. Final Report. Zigmund Z. Ziporin, Jerry Ann Tillotson, Roy Solkot, John W. Needham, and A. J. Bauer. Jan. 22, 1959. 14p. Project No. 6-60-11-020. (AD-216878).

There were no significant differences in the weight gains of rats receiving 725r of total body radiation when compared with unirradiated controls pair-fed with the same streptomycin-containing synthetic diet. Dietary supplements of liver extract or of whole liver had the

same effects on the weight change of irradiated and control rats. The survival of rats receiving 750r of total body radiation was slightly greater, but not significantly so on a laboratory chow diet than on a synthetic diet, but dietary supplements had no apparent effects. (auth)

21831 CNB-4

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

SELEZIONE ARTIFICIALE PER UN CARATTERE QUANTITATIVO IN POPOLAZIONI DI DROSOPHILA MELANOGASTER IRRADIATE CON RAGGI X. (Artificial Selection for a Quantitative Trait in Drosophila Melanogaster Populations Treated with X-Rays.) R. E. Scossiroli. July 1959. 218p.

Selection for high and low number of sternopleural hairs was conducted on x-irradiated plateaued lines of Drosophila to determine in x irradiation can induce new variability for further selection. The results showed that in selection for high number of hairs, treatments with high doses of x radiation (3000 r every other generation) were effective in producing a large selection response. Selection in non-irradiated lines were almost ineffective. In the selection for a low number of hairs, the irradiation is ineffective. The selection response in irradiated lines is associated with an increase of genetic variability. In the irradiated lines a strong reduction of fitness (increase of sterility and decrease of fertility) is observed. This decrease in the fitness is caused only in part by specific mutations induced by x radiation; it is associated with the response to the intense selection applied. After a relaxation of the selection and a suspension of the treatment, there is a regression of the average value of the selection characteristic which is stabilized at a higher level, however, than that at the beginning of the experiment. An improvement in the fitness is also observed. The importance of polygene mutability and the importance of the results obtained for plant and animal breeding are discussed. (tr-auth)

21832 ORNL-1671(Del.)

Oak Ridge National Lab., Tenn.

NEUTRON FLUX AND TISSUE DOSE STUDIES WITH FISSION THRESHOLD DETECTORS. PART I. EXPERIMENTAL MEASUREMENTS. G. S. Hurst, J. A. Harter, P. N. Hensley, W. A. Mills. Mar. 30, 1954. Decl. with deletions Aug. 14, 1959. 13p. Contract W-7405-eng-26. $3.30(ph), $2.40(mf) OTS.

Methods and apparatus are described which were developed for the purpose of making neutron measurements in an effort to define tissue dose in terms of energy dissipated per gram of average wet tissue. The apparatus was used for measurements of radiation from an atomic explosion. The energy response of Pu^{239}, Np^{237}, U^{238}, Au, and S permitted the neutron energy spectrum to be resolved into five energy groups. A NaI scintillation counter was used to detect low-energy γ rays from the Pu fission products. Calibration of the system of threshold detectors is described, and typical field results are presented. (W.L.H.)

21833 ORNL-2755

Oak Ridge National Lab., Tenn.

DETERMINATION AND EVALUATION OF THE RADIATION FIELD ABOVE WHITE OAK LAKE BED (thesis). P. K. Lee and S. I. Auerbach. Sept. 25, 1959. 72p. Contract W-7405-eng-26. $10.80(ph), $3.90(mf) OTS.

Submitted to Vanderbilt Univ.

The radiation above the contaminated soil of White Oak Lake bed was characterized in terms of horizontal and vertical distribution of air dose rates over most of the bed. These data are needed for studies investigating effects of this chronic low-level radiation upon mammals and other organisms inhabiting the area. (auth)

21834 USNRDL-TR-351

Naval Radiological Defense Lab., San Francisco.

INFLUENCE OF DIET FAT ON POST-IRRADIATION GROWTH AND FOOD UTILIZATION IN THE RAT. W. H. Goldwater and C. Entenman. Aug. 13, 1959. 24p.

Studies were made on the influence of diet fat on growth in control and irradiated rats. Animals were fed aritificial diets containing 19% protein from skim milk powder, and furnishing 0, 37, or 68% of diet calories as either added corn oil or butter fat. Rats from each diet group were treated with 3 biweekly doses of 300 r each, to administer a maximal injury with minimal acute mortality. Best growth occurred in control and irradiated rats on the high butter diet, with the moderate corn oil diet next best; poorest growth occurred on the fat-deficient diet. Best growth did not require high levels of calorie or protein intake, but it did accompany most efficient utilization of diets. Since irradiated animals ate about as much as their unirradiated controls, the 20% lower weight gains of the former seem to result primarily from decreased efficiency of diet calorie and protein utilizations. These latter were least adversely affected by irradiation in rats on the high butter diet. (auth)

21835 WT-1013

Scripps Institution of Oceanography, La Jolla, Calif.

EFFECTS OF NUCLEAR EXPLOSION ON MARINE BIOLOGY. M. B. Schaefer, ed. Aug. 1956. Changed from OFFICIAL USE ONLY Apr. 15, 1959. 144p. Project 2.5 [of] OPERATION WIGWAM. $22.80(ph), $7.20(mf) OTS.

This report supersedes ITR-1063.

The distribution of marine organisms (phytoplankton, zooplankton, tuna, and other fish) in the Pacific test area was studied. The uptake of fission products, especially Sr-90 and Y-90, by these organisms was also investigated. (C.W.H.)

21836 CEA-tr-A-580

DETERMINATION DE L'URANIUM DANS LES PLANTES VIVANTES ET MORTES. (Determination of Uranium in Living and Dead Plants.) (Résumé). Josef Hoffmann. Translated into French from Bodenk. u. Pflanzenernahr. 26, 318-27(1942). 11p.

A study was made of the uptake of uranium by plants. The treatment of the plants by drying, flaming, and incinerating is described. The analytical procedure, which is based on the spectrophotometric determination of uranium, is outlined. All the plants examined have traces of uranium which shows that the plants assimilate uranium in their food. (J.S.R.)

21837 JPRS-L-639-N

REFLEX EFFECTS FROM INTERNAL ORGANS ON THE FUNCTION OF THE GASTRO-INTESTINAL TRACT IN IRRADIATED ANIMALS. Ye. A. Brodskaya. Translated from Arkh. Patol. 20, No. 11, 53-8(1958). 8p. $0.50(OTS).

Irradiation of dogs at a dose of 275 to 293 r elicits, in addition to changes in the activity of the gastrointestinal tract, marked disturbances in the interoceptive

reflex arc from receptors of the rectum on the secretory, excretory, and motor functions of the stomach and on the secretory functions of the small intestine. A certain phasic character in these changes may be discerned. The phases are: (1) latent period of radiation sickness, (2) period of clinical manifestations, and (3) period of recovery and clinical well-being. Especially noticeable changes in the transmission of interoceptive impulses were seen during the third phase. These lasted over a period of six to eight months after irradiation, with no evidence of a tendency toward normalization. Stimulation of the receptors led to variable disturbances of transmission of influences from the rectum on the functions of the gastrointestinal tract in the irradiated animals: increased interoceptive influence on the secretory and excretory functions of the stomach and small intestine, and reduction, with occassional complete disappearance, of the motor functions. More profound disturbances of the secretory and excretory functions of the stomach, and of the secretory functions of the small intestine, were seen in the first hour of secretion, during stimulation of the rectal receptors. Thus, under the influence of ionizing irradiation, there are significant disruptions in the interoceptive apparatus of the intestine, which, obviously, represents a factor complicating and rendering more formidable the course of the disease, as well as being one of the sources of pathologic impulses. (auth)

21838

PROLIFERATIVE POTENTIALS OF BONE MARROW AND BLOOD CELLS STUDIED BY IN VITRO UPTAKE OF H^3-THYMIDINE. V. P. Bond, T. M. Fliedner, E. P. Cronkite, J. R. Rubini, G. Brecher, and P. K. Schork (Brookhaven National Lab., Upton, N. Y.). Acta Haematol. 21, No. 1, 1-15(1959).

Cell proliferative activity and potential in the circulating blood and in the bone marrow of individuals with normal hematopoiesis, and in patients with hematopoietic dyscrasias was studied by means of in vitro one hour incubation with tritiated thymidine (H^3Th) and stripping film autoradiography. The labeled material is incorporated only into DNA during synthesis. In normal bone marrow, labeling was seen at 1 hour in all cell lineages, and in cells variously referred to as "reticulum," "stem," "stroma," etc., cells. Erythropoietic cells were labeled as far as the polychromatic normoblast; the myeloid series was labeled to the myelocyte state. Leukemia cells in the bone marrow and peripheral blood of patients with acute or chronic myelocytic leukemia incorporated label avidly; the small typical leukemia cell of chronic lymphocytic leukemia did not label at all. Less than 3 per cent of the myeloma cells in patients with multiple myeloma incorporated thymidine. Most striking was the finding of small numbers of labeled large mononuclear cells of different morphological types in the peripheral blood of normal human beings, and an increase in the number of morphologically identical cells in the blood of patients with infection and infectious mononucleosis. The labeling indicates active DNA synthesis and thus these cells presumably are capable of division. It is suggested that these cells may represent a mobile pool of primitive progenitor cells and are multipotential in their function. (auth)

21839

THE MITOTIC INDEX OF HUMAN BONE MARROW IN HEALTHY INDIVIDUALS AND IRRADIATED HUMAN BEINGS. Theodor M. Fliedner, Eugene P. Cronkite, Victor P. Bond, Joseph R. Rubini, and Gould Andrews (Brookhaven National Lab., Upton, N. Y. and Oak Ridge Inst. of Nuclear Studies, Tenn.). Acta Haematol. 22, No. 2, 65-78(1959).

The mitotic index of the bone marrow of 7 healthy individuals was determined in Feulgen stained squash preparations to be 0.9% for the time 10 a.m. to 1 p.m. The method did not allow the distinction of mitoses of different cell lineages. On the basis of this mitotic index, it is possible to estimate the average turnover time of the red cell series to be in the order of 11 to 33 hours and that of the white cell series to be in the order of 25 to 75 hours. In serial studies the mitotic index of 8 patients, accidentally exposed to various doses of ionizing radiation, was followed over a period of 4.5 months. A dose dependence of the mitotic index was noticed on the fourth post-irradiation day. After 4 weeks, the number of mitotic figures was within normal limits. After 4.5 months the values were significantly higher than normal. (auth)

21840

STUDIES ON THE METABOLISM OF NUCLEIC ACID IN CARCINOMA CERVIX UTERI, WITH PARTICULAR REFERENCE TO CHANGES DUE TO IRRADIATION WITH Co^{60}. Ken-ichi Taira (Niigata Univ., Japan). Acta Med. et Biol. (Niigata) 6, 317-31(1959) Mar.

In biochemical studies on the cellular constituents of tumor tissues in 20 cases of carcinoma cervix uteri irradiated with Co^{60} and in 15 controls not irradiated, the quantitative determinations for various phosphoric fractions, i.e., acid-soluble P, lipid-P, RNA-P, and DNA-P, showed the DNA-P diminish with statistical significance in the irradiated groups. The other fractions remained unchanged by irradiation. Study of the influence of irradiation on the P^{32} incorporation into the different fractions in terms of relative specific activity (RSA), found the P^{32} incorporation into only the DNA fractions remarkably inhibited; and the incorporation of P^{32} into RNA was also diminished to some extent but not to such an extent as would show a statistically significant difference from the findings in the controls. Similar experiments using different doses of Co^{60} irradiation led to this finding: the quantitatively determined values and RSA exhibited marked decline in DNA-P with increasing doses of the irradiation, and tended to decrease in RNA following irradiation at high doses. As for the relationship between the histological grades of carcinoma cervix uteri and cellular constituents, the higher the histological grade the more was the amount of DNA-P, with marked rise in the P^{32} incorporation into DNA. These appeared capable of being used as an index for the histological grade of malignancy. While RNA-P was practically not affected by rise in the histological grade, the P^{32} incorporation into RNA rose to some extent with rise in the histological grade. The irradiation of the histologically classified groups showed that the higher the histological grade of malignancy in the group the lower were the amount of DNA-P and RSA. (auth)

21841

EFFECTS OF SINGLE DOSE PROTON IRRADIATION OF NORMAL SKIN AND V × 2 CARCINOMA IN RABBIT EARS. A Comparative Investigation with Protons and Roentgen Rays. Sture Falkmer, Börje Larsson, and Stig Sténson (Gustaf Werner Inst. for Nuclear Chemistry, Uppsala and Univ. of Uppsala). Acta Radiol. 52, 217-34 (1959) Sept.

Normal rabbit skin and subcutaneously implanted

V × 2 carcinoma were irradiated with protons from a synchrocyclotron, the Bragg peak region of the proton beam being used. The effect was compared with that of 220 kv roentgen rays. Qualitatively the regressive changes were the same. Semi-quantitative grading of the radiation-induced gross changes of the skin showed that protons produced less damage than approximately equivalent doses of roentgen rays. Semi-quantitative grading was also applied to the microscopic regressive changes evoked in the V × 2 carcinoma cells during the first week after irradiation. The proton beam had approximately the same ability as conventional roentgen rays to produce early regressive changes at roughly corresponding doses. The findings give biological support to the idea that the proton beam, with its advantageous physical properties, may be used to treat malignant tumors. (auth)

21842

BONE MARROW TRANSPLANTATION AND CHEMICAL PROTECTION IN THE RADIOTHERAPY OF MOUSE LEUKEMIA. Emanuel E. Schwartz (Oak Ridge National Lab., Tenn.). Acta Radiol. 52, 235-40(1959) Sept.

Attempts were made to extend the radiation-induced survival of mice, bearing transplanted lymphomas, by the use of isologous bone marrow or the radioprotective chemical AET. Increased amounts of radiation tolerated by virtue of post-treatment with isologous bone marrow prolonged survival beyond that obtainable with sublethal doses of roentgen rays alone. Increased amounts of radiation tolerated by virtue of pretreatment with AET also further prolonged survival in one of the 2 transplanted lymphomas studied, which suggests that in this instance normal tissues received greater protection than the lymphoma. Fractionated or protracted irradiation was not significantly more effective than a single brief exposure under the conditions tested. (auth)

21843

USE OF A GAMMA RAY SPECTROMETER FOR INVESTIGATION OF PLUTONIUM CONTAMINATED WOUNDS. E. P. Putzier, J. R. Mann, and V. P. Johnson (Dow Chemical Co., Denver). Am. Ind. Hyg. Assoc. J. 19, 384-5(1958) Oct.

The use of a gamma spectrometer to estimate Pu in wounds by measuring L x rays from Pu^{239} is described. Good agreement was obtained between in vivo measurements before and after excision and alpha particle analysis of the excised tissue. With the equipment used, the estimated lower limit of sensitivity is 0.1 μg of Pu^{239}. (T.R.H.)

21844

RADIATION-INDUCED GENETIC MARKERS IN THE STUDY OF LEAF GROWTH IN ZEA. Otto L. Stein and Dale Steffensen (Montana State Univ., Missoula and Brookhaven National Lab., Upton, N. Y.). Am. J. Botany 46, 485-9(1959) July.

Corn embryos heterozygous for the plant color mutant yellow-green were treated with moderate doses of radiation. The sectors resulting from the loss of the dominant gene Yg_2 furnish a graphic illustration of the growth of an organ in space and time. Wet embryos were irradiated and leaves 3 through 6 were analyzed. The total number of sectors per leaf increases in relation to the amount of leaf tissue present at time of irradiation and their distribution varies, indicating a change in mitotic activity during early ontogeny of the leaf. As represented by leaf 6 in the mature embryo, cell division is rather uniform throughout the young primordium. Soon thereafter (leaf 5) cell divisions in the apical region increase, though cell lineages remain short. In the basal region of the leaf, the proportion of cell division decreases but those cells which do divide continue their activity over a longer period than the apical cells. Longer files of mutant cells are formed in such a way. The mid regions of the leaf maintain their status quo in terms of distribution of sectors. The results indicate that differentiation of the intercalary meristem as a thin band occurs early in the development of the leaf primordium. The use of genetic techniques in conjunction with radiation, in this case as a "timed" release of genetic markers, may be a useful tool in the precise analysis of the dynamic aspects of organogenesis and histogenesis. (auth)

21845

CLINICAL AND PHYSIOLOGIC RESULTS FOLLOWING RADIOACTIVE IODINE (I^{131}) IN THE TREATMENT OF CHRONIC PULMONARY INSUFFICIENCY. Lois T. Ellison, B. Shannon Gallaher, Irene F. LaMotte, William F. Hamilton, Jr., Robert G. Ellison, and W. F. Hamilton (Medical Coll. of Georgia, Augusta). Am. Rev. Respirat. Diseases 80, 181-7(1959) Aug.

Twenty-three patients with severe pulmonary insufficiency were followed for two and one-half to three and one-half years after treatment with radioactive iodine. Clinical and physiologic results are presented. Clinical improvement was excellent in 7 patients (30 per cent), good in 2 (9 per cent), fair in 6 (26 per cent), and poor in 8 (35 per cent). Pulmonary function studies revealed no significant improvement in lung volumes or in the mechanics of breathing. In the majority of patients, oxygen uptake and I^{131} uptake were reduced, total and alveolar ventilation decreased, alveolar and arterial oxygen tension increased, and the arterial carbon dioxide tension decreased. The clinical improvement did not always show a correlation with the values determined in the laboratory. (auth)

21846

OCULAR EFFECTS OF RADIATION. David G. Cogan (Harvard Medical School, Boston). A.M.A. Arch. Ind. Health 20, 293-6(1959) Oct.

Anatomic and physiologic features of the eye are reviewed to point out its vulnerability to radiation. The types of damage resulting from radiodiathermy, infrared, visible spectrum, UV, and ionizing radiation are pointed out. (T.R.H.)

21847

IRRADIANCE THRESHOLDS FOR CHORIORETINAL LESIONS. Donald W. DeMott and Thomas P. Davis (Univ. of Rochester, N. Y.). A.M.A. Arch. Ophthalmol. 62, 653-6(1959) Oct.

With use of a high-intensity light source to produce chorioretinal lesions in the eyes of rabbits, cats, and guinea pigs, we determined, at different levels of retinal irradiance, the exposure time which produced an ophthalmoscopically visible lesion it was found that at irradiance levels greater than 2 cal. per square centimeter per second a radiant exposure of 1.0 cal. per square centimeter produced a threshold lesion. At irradiance levels less than 0.7 cal. per square centimeter per second lesions could not be produced at any exposure time through 10 seconds. Histological data on the nature of the lesions and course of healing are presented and discussed. (auth)

21848

ROSE BENGAL AND IODOPYRACET AS RADIODIAGNOSTIC AGENTS IN LIVER AND KIDNEY DISEASES. G. V. Taplin, O. M. Meredith, Jr., C. C.

Winter, and D. Johnson (Univ. of California, Los Angeles; Veterans Administration Center, Los Angeles; and Los Angeles County Harbor General Hospital, Torrance, Calif.). Ann. N. Y. Acad. Sci. 78, 872-93 (1959) July 2.

The rose bengal hepatogram is now established as a highly sensitive liver function test that also supplies diagnostic information on vascular abnormalities of the liver and on the degree of biliary tract obstruction. No other single procedure gives as much useful information for the differential diagnosis and management of patients with diseases of the liver and biliary tract. The rose bengal-BSP blood clearance stress test is capable of detecting minimal liver damage in rabbits and asymptomatic liver disease in man. However, further investigation is needed for final assessment of its maximum sensitivity. New tracer techniques using colloidal gold^{198} and rose bengal have been developed in animal studies for further evaluation of liver vascular disorders; both procedures are clinically applicable. The Diodrast renogram is becoming recognized as a simple, rapid, nontraumatic office procedure for estimating individual kidney functions. It is especially valuable as a screening test for hypertensive patients suspected of having disease of one kidney. Most hypertensives with normal renograms may be spared the discomfort, time, and expense of hospitalization and complicated urological diagnostic procedures. Recent modifications in the instrumentation and the use of Miokon in place of Diodrast have increased the reliability of the renogram while simplifying its performance. These tracer tests are unique in providing data on multiple functions simultaneously with complete freedom from drug reactions; radiation exposure is many times less than from X-ray examinations of these organs. (auth)

21849

THE FUNCTION OF THE DONOR TISSUE IN EXPERIMENTAL OPERATIONS WITH RADIOACTIVE BONE GRAFTS. Marshall R. Urist, Norman S. MacDonald, and Jenifer Jowsey (Univ. of California, Los Angeles and Argonne National Lab., Lemont, Ill.). Ann. Surg. 147, No. 2, 129-45(1958) Feb.

The experiments show, with the aid of radioisotope labeled rabbit bone transplants into clean hosts, that the donor tissue can accomplish its purpose (to induce the host to fill a defect, to fuse a joint, to unite a fracture) when less than one-third of its total mass has been absorbed and replaced by the host. The bone matrix and the bone mineral are absorbed together and the labeled mineral constituents are dissolved and carried into the systemic circulation of the host and not transferred locally to the host bed. When a bone graft "takes," the donor tissue becomes adjoined to the host by a cement line formed by the host by condensation of mucopolysaccharides with the histochemical characteristics of chondroitin sulfate. When a bone graft operation fails, the donor tissue becomes encapsulated in an envelope of fibrous tissue and is virtually outside the body. In a successful bone graft the host grows into the donor tissue in an orderly pattern and not by haphazard growth; the trabeculae of new bone from the host bed grow into the donor and each one finds a trabecula of dead bone on which to attach itself in the most efficient way; thus the function of the donor tissue in all bone graft operations is to provide a network of slowly absorbed surfaces upon which the host is induced to condense the cement line and deposit the new bone. The induction of new bone formation by a bone transfer is a non-specific reaction, the mechanism of which is not yet known, and requires further investigation. (auth)

21850

INTERMEDIATE NUCLEOTIDE METABOLISM IN BONE MARROW IN NORMAL SUBJECTS AND AFTER X-RAY IRRADIATION. G. A. Krit-skii (A. N. Bakh Inst. of Biochemistry, Academy of Sciences, Moscow). Biochemistry (USSR) (English Translation) 24, 65-70(1959) Jan.-Feb.

The low molecular weight purine and pyrimidine compounds in bone marrow before and after irradiation were separated into eight fractions; we established the positions of these fractions under definite conditions of paper chromatography and also determined spectrophotometrically the content of these fractions. We showed in parallel chromatograms with definite nucleotides that the sixth fractions which was present in the greatest amount of all the low molecular purine and pyrimidine compounds was adenylic acid. The content of low molecular weight purine and pyrimidine fractions of bone marrow decreased in two days after localized x-ray irradiation with a dose of 2000 r. The total amount of the studied fractions in bone marrow of an irradiated leg decreased by about 60% compared to an unirradiated leg of the same animal. We have suggested possible reasons for the decreased content of nucleotides in bone marrow after irradiation and the physiological significance of this. Two days after localized x-ray irradiation of one leg of a rabbit with a dose of 2000 r, the enzymatic activity of the bone marrow of this leg, in splitting off from DNA of purine and pyrimidine compounds which are soluble in 60% alcohol, decreased differently in different buffer solutions: in tris buffer solution by 43%, in orthophosphate buffer solution, by 20%. (auth)

21851

COMPLETE LABELING OF THE ORGANIC SUBSTANCES OF PLANTS BY RADIOACTIVE CARBON AS A METHOD FOR STUDYING METABOLIC DISTURBANCES. A. M. Kuzin and V. I. Tokarskaya (Inst. of Biological Physics, Academy of Sciences, Moscow). Biochemistry (USSR) (English Translation) 24, 71-7 (1959) Jan.-Feb.

We have described a new method for studying disturbances of metabolism after the action of various physical, chemical, or biological factors. The method is based on use, for experimental organisms, of complete labeling by C^{14} and has been used for the study of disturbance of metabolism in plants under the influence of ionizing radiation. We have shown an increase in exosmosis of organic substances from the roots of irradiated plants, and determined the nature of these substances. We have shown a characteristic disturbance in metabolism in leaves and roots of irradiated plants. We have studied the radiochromatograms obtained from different fractions from fully C^{14}-labeled organisms, and this has allowed us to judge the changes in quantitative ratio of metabolites, and the disappearance or appearance of different substances under the influence of various agents as compared to the normal state. (auth)

21852

EFFECTS OF DOSE-RATE AND PROTRACTION: A SYMPOSIUM. I. PATTERNS OF RESPONSE TO WHOLE-BODY IRRADIATION: THE EFFECT OF DOSE INTENSITY AND EXPOSURE TIME ON DURATION OF

LIFE AND TUMOUR PRODUCTION. R. H. Mole (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Brit. J. Radiol. 32, 497-501(1959) Aug.

The lethal effects and functional deficiencies produced by continued daily whole-body irradiation appear to show two distinct patterns of response. Differences in dose-intensity of the radiation exposure and in LET of the type of radiation do not seem to be important when the biological damage may be plausibly interpreted as depending on cell depletion. Where re-population of irradiated tissues can occur as a consequence of cell division, adaptation to continued irradiation regularly occurs, i.e., in spite of continuing injury, damage is not progressive but reaches a steady state. Damage is then dependent on average dose-rate rather than on total dose, and differences of a few-fold in average dose-rate may change the degree of damage from gross to barely measurable. Increasing the over-all exposure time during which a fixed total dose is given always reduces the effect. A contrasting pattern of response is shown in the induction of murine leukemia, and also in shortening of life, since the degree of life-shortening and the shape of the mortality curve after limited periods of daily irradiation by x rays, γ rays or fast neutrons, was found to depend markedly on the amount of leukemia produced. Increasing the over-all exposure time may increase the effect of a given total dose, and the dose-intensity of the individual radiation exposures may be quantitatively important. There is also a markedly curvilinear relation between dose and response. (auth)

21853

EFFECTS OF DOSE-RATE AND PROTRACTION: A. SYMPOSIUM. II. ADAPTATION TO CONTINUOUS IRRADIATION: OBSERVATIONS ON THE RAT INTESTINE. H. Quastler (Brookhaven National Lab., Upton, N. Y.) and J. P. M. Bensted, L. F. Lamerton, and S. M. Simpson (Inst. of Cancer Research, Royal Cancer Hospital, London). Brit. J. Radiol. 32, 501-12 (1959) Aug.

A study has been made of the response of the intestinal epithelium of the rat to continuous irradiation at dosage rates up to 415 rads per day. Soon after the commencement of irradiation, signs of radiation injury appear in the crypts and villi, but these changes are not progressive and a steady or near-steady state develops. The cells may acquire increased radiation resistance; a possible mechanism is discussed. (auth)

21854

EFFECTS OF DOSE-RATE AND PROTRACTION; A SYMPOSIUM. III. PROBLEMS OF INJURY AND REPAIR IN TISSUES AND CELLS: A REVIEW. G. Payling Wright (Dept. of Pathology, Guy's Hospital Medical School, London). Brit. J. Radiol. 32, 512-16(1959) Aug.

Reaction mechanisms involved in cell injuries are discussed. It is stated that injuries induced by ionizing radiations have created many new problems. It must be determined whether these injuries are so distinctive as to form a class by themselves, or whether they merely provide additional instances of lesions that are already essentially familiar. (C.H.)

21855

EFFECT OF X RAYS ON UPTAKE OF ^{32}P BY THE MOUSE KNEE JOINT WHEN THE X-RAY DOSE IS GIVEN IN TWO CAREFULLY SPACED FRACTIONS. C. W. Wilson (Westminster Hospital, London). Brit. J. Radiol. 32, 547-51(1959) Aug.

The depression of uptake of P^{32} in the mouse knee-joint produced by two separate x ray dose fractions delivered at carefully chosen intervals is compared with that produced by a single dose equal to the sum of the fractions. It is found that the effect of the second fraction is less than might reasonably be expected and that there is a latent period of at least one week following the second dose in the same way as there is for a single dose. In a discussion which compares these results with somewhat similar experiments done by other workers using other tissues, the possible importance of time spacing of dose for radiotherapy is emphasized. (auth)

21856

INJURY AND REPAIR FOLLOWING IRRADIATION OF SALIVARY GLANDS IN MALE RATS. C. P. Cherry and A. Glucksmann (Strangeways Research Lab., Cambridge, Eng.). Brit. J. Radiol. 32, 596-608(1959) Sept.

The weights, histology, histochemistry, and mitotic indices of salivary glands in male rats were analyzed and the long term effects of local irradiation on the main components of the parotid, sublingual, and submandibular studied. The excretory ducts are least and the acini are most affected by radiation while the intercalated ducts and the submandibular secretory tubules are intermediate. An initial period of predominantly degenerative changes is followed by a phase of regeneration and abnormal repair which leads to the appearance of adenomas in the sublingual and submandibular but not in the parotid. In the parotid acini only show regenerative activity and repair the injury caused by low, but not by high doses of radiation. In the submandibular and sublingual partial and unsuccessful regeneration of acini follows radiation injury and elicits excessive proliferation of intercalated ducts which leads to the formation of adenomas. Irradiation produces changes in the type, amount, and direction of discharge of the secretion and in the polarity of cells of sublingual and submandibular acini. The intercalated ducts of the parotid lose their cytoplasmic granules while those of the sublingual are stimulated to form mucin. The activity of the secretory tubules of the submandibular appears to be relatively increased by radiation. The relation of the radiosensitivity of the various glandular components to their mitotic and functional activities and to their regeneration pattern is discussed. (auth)

21857

A METHOD FOR ESTIMATING MITOTIC RATES IN VICIA ROOTS AFTER X IRRADIATION. Douglas Davidson (Oak Ridge National Lab., Tenn.). Brit. J. Radiol. 32, 612-14(1959) Sept.

A method is described for estimating mitotic rates in root cells of Vicia faba. The procedure was used in studies on root cells in plants grown from irradiated beans. Results are discussed. (C.H.)

21858

STORAGE OF GAMMA IRRADIATED POTATOES AND ONIONS. M. Blinc (Chemical Inst. "Boris Kidrič" Academy, Ljubljana, Yugoslavia). Bull sci., Conseil acad. RPF Yougoslovie 4, 102(1959) Apr.

The storage quality of potatoes was investigated at various time intervals after γ irradiation to 3700, 7000, and 27,000 rep. Sprouting and decay in good organoleptic conditions are prevented beyond 7000 rep. Beyond 7000 rep onion sprouting is not prevented but sprout growth is retarded and the onions remain firm. (T.R.H.)

21859

EFFECT OF X IRRADIATION ON THE METABOLISM

OF C^{14}-GLUCOSE AND C^{14}-FRUCTOSE IN RAT LIVER SLICES. P. V. Vittorio, W. P. Spence, and M. J. Johnston (Kingston Lab., Ont., Can.). Can. J. Biochem. and Physiol. 37, 787-92(1959).

The utilization of C^{14}-glucose and C^{14}-fructose in liver slices from normal rats and from rats exposed to 1000 r of whole-body X irradiation was studied. Liver slices prepared from normal rats were incubated with C^{14}-glucose or C^{14}-fructose in equivalent amounts and the incorporation of C^{14} into carbon dioxide, glycogen, and an ethanolic extract was determined. After the rats had been fasted 4 or 24 hours the amount of C^{14} incorporated into glycogen and carbon dioxide from C^{14}-fructose was greater than that incorporated from C^{14}-glucose but the total radioactivity in the ethanolic extracts was approximately the same for both hexoses. When liver slices prepared from normal and X-irradiated rats were incubated with C^{14}-glucose or C^{14}-fructose 4 or 24 hours after irradiation, the samples obtained from irradiated rats incorporated a greater amount of C^{14} into carbon dioxide, glycogen, and the ethanolic extract, with the exception of the 24-hour samples incubated in the presence of labelled glucose. In the latter instance incorporation into carbon dioxide fell below the normal value. The total C^{14} recovery from the three fractions was always higher in the X-irradiated samples than in the corresponding control samples. Further examination of the ethanolic extracts (amino acids, lactic acid, and origin area material) separated by paper partition chromatography revealed additional differences between the samples of liver from normal and X-irradiated rats in their ability to incorporate C^{14} from either labelled hexose. These differences were apparent in samples incubated either 4 or 24 hours after X irradiation of the animals. (auth)

21860

THE EFFECT OF IONIZING RADIATION ON IMMUNITY. A REVIEW OF LITERATURE AND A PRELIMINARY OBSERVATION OF RESULTS OF IRRADIATION ON ANIMALS INFECTED BY B. PARATYPHI AND B. DIPHTHERIAE. Chi-pi Wan. Chung Hua Fang Shê Hsüeh Tsa Chih 6, No. 2, 141-5(1958). (From Sci. Abstr. China; Biol. Sci. No. 2, 1958, Abstract No. 411.)

Rabbits and guinea pigs were infected by B. paratyphi and B. diphtheriae, respectively. The route of infection for B. paratyphi was per oral and that for B. diphtheriae was by subcutaneous inoculation. Dosage for infection was so adjusted that all the experimental animals got the disease without mortality. Total body irradiation was given between the interval of ingestion and development of clinical symptoms or innoculation at the height of radiation syndrome. The dosage was 300 r from a 200 kv machine. Mortality rate was greatly increased and antibody formation markedly depressed by total body irradiation. Infection by B. diphtheriae at the height of radiation syndrome caused 100% mortality (total body irradiation animals infected by B. paratyphi caused 50% mortality) whereas the mortality of the control groups was nil. Chloromycetin reduced the mortality rate of the group of animals infected by B. paratyphi plus total body irradiation. (auth)

21861

EFFECT OF X RAYS ON THE BIOSYNTHESIS OF NUCLEIC ACIDS AND MUTATION PROBLEMS. Paul Mandel, Pierre Chambon, Marguerite Wintzerith, Nicole Kelin, and Liba Mandel (Institut de Chimie biologique, Faculté de Médecine, Strasbourg). Compt. rend. 249, 582-4(1959) July 27. (In French)

The evolution of the absolute quantity of nucleic acids and of free ribo- and desoxyribonucleotides and the incorporation of P^{32} in the nucleic acids and ribonucleotides were studied at various periods after irradiation with 325, 500, and 700 r of x radiation. An accumulation of the nucleotide precursors of ribo- and desoxyribonucleic acids (RNA and DNA) was observed in the spleen and in ascitic hepatomas after irradiation. This phenomenon can produce an abnormal ratio between the nucleic acid precursors, giving rise to a biosynthesis of DNA different from that of the original cells. This, in turn, can lead to mutations. (J.S.R.)

21862

EFFECT OF A SPECIFIC SEROTHERAPY ON THE RADIOSENSITIVITY OF THE TESTICLE. Jean Loiseleur, Liliane Catinot, and Annick Thobie. Compt. rend. 249, 892-4(1959) Aug. 24. (In French)

The injection of a cytotoxic serum before irradiation decreases the radiosensitivity of the tissue corresponding to the serum used. The anti-testicle serum, associated with the anti-bone marrow serum, protects the rat testicle against x radiation. (tr-auth)

21863

SOME STATEMENTS ON THE NATURE AND PROPERTIES OF RADIOACTIVE FALL-OUT FROM ATOMIC EXPLOSIONS SINCE 1945. Linus Pauling, Shoichi Sakata, Sin-itiro Tomonaga, Jean-Pierre Vigier, and Hideki Yukawa. Compt. rend. 249, 982-4(1959) Sept. 14. (In French)

Some numbers relating to fall-out buildup in the atmosphere and biosphere since 1945 are pointed out. In particular, the figures for Sr^{90} and C^{14} are given and discussed as to biological effects. (T.R.H.)

21864

A COMPARATIVE ANALYSIS OF THE BIOLOGICAL EFFECT OF IONIZING RADIATION AND METHYL-BIS-(β-CHLORETHYL)-AMINE (HN2) WITHIN A LARGE RANGE OF DOSES. R. G. Kostianovski and S. P. Yarmonenko (Inst. of Chemical Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 127, 1294-6(1959) Aug. (In Russian)

Characteristics of injuries inflicted by 1 to 2000 mg/kg doses of HN2 (methyl-bis(β-chloroethyl)amine) were studied in 568 white mice. The hydrous solutions of HN2 were introduced intraperitoneally. Logarithmic graphs correlating the lethal effects of high radiation doses and HN2 show great similarity; the graphs coincide at the point of minimum lethal doses (750r and 4 mg/kg). The basic similarities in the lethal effects also indicate a similarity of mechanisms inducing the injuries. (R.V.J.)

21865

ALPHA IRRADIATION OF PARTS OF SINGLE CELLS IN TISSUE CULTURE. III. IRRADIATION OF CHICK FIBROBLASTS DURING METAPHASE AND ANAPHASE. T. R. Munro (Christie Hospital, Manchester, Eng. and Holt Radium Inst., Manchester, Eng.). Exptl. Cell Research 18, 76-99(1959) Aug.

In order to investigate the relative importance of damage to nuclear material and cytoplasm when cells are exposed to ionizing radiations, parts of dividing chick fibroblasts in tissue cultures have been irradiated with alpha particles. The particles came from polonium deposited on the tip of a micro-needle; they had a well defined range, and accordingly, if the micro-needle was suitably positioned, a selected part of a cell could be irradiated. If small doses were delivered to the chro-

mosomes at metaphase, sticky bridges were seen at anaphase. Larger doses would, in addition, inhibit nuclear reconstruction at telophase. Irradiation of one group of chromosomes during early anaphase with similar doses inhibited nuclear reconstruction in the corresponding daughter cell, but not in the unirradiated one. Irradiation of part of the cytoplasm and spindle at metaphase did not produce sticky bridges at anaphase, inhibit telophase, or induce any visible abnormality. The normal process of nuclear reconstruction at telophase in these cells is described. The clumped late-anaphase chromosomes spread, and the nuclear membrane first becomes visible, at a regular 8 minutes after the beginning of anaphase. The sensitivity to inhibition of nuclear reconstruction decreased sharply 5 to 6 minutes after anaphase had begun (i.e., 2 to 3 minutes before the nucleus was re-formed). (auth)

21866

STUDIES ON NUCLEI. I. PHYSICAL PROPERTIES OF DEOXYRIBONUCLEOPROTEIN FROM RAT THYMUS IN 1 M SODIUM CHLORIDE. W. D. Fisher, N. G. Anderson, and K. M. Wilbur (Oak Ridge National Lab., Tenn. and Duke Univ., Durham, N. C.). Exptl. Cell Research 18, 100-11(1959) Aug.

,Treatment of dilute rat thymus breis with concentrated NaCl solutions produced viscous solutions that were permanently disrupted by shearing. Attempts to measure the viscosity of such extracts in ordinary capillary viscometers were unsuccessful; however, reproducible measurements of apparent relative viscosity (±2 to 3 per cent) were obtained by timing the first passage of the extracts through a modified Cannon-Fenske viscometer. The viscosity of extracts prepared in 1 M NaCl reached a maximum and constant value only after 10 to 12 hours of extraction at room temperature (25 to 27°C). The maximum apparent relative viscosity of the extracts varied logarithmically with homogenate concentration. The viscosity of the extracts was markedly affected by pH. From pH 6.4 to pH 8.5, the viscosity was relatively constant; below pH 6.4, it fell rapidly, and, at lower pH's, was the same as for the solvent. Above pH 8.5, the specific viscosity increased rapidly to a maximum of about pH 10 and then dropped to zero at pH 11.5. The viscosity of the extracts was low in 0.05 to 0.4 M NaCl concentrations but increased rapidly in concentrations of 0.6 to 0.9 M. The viscosity of the extracts continued to rise slowly as the NaCl concentration was raised to 2 M but then decreased when the concentration was raised above 2 M. Viscosity decreased when the extracts or the breis from which the extracts were prepared were frozen. The results indicate that at least two types of protein-DNA bonds exist. The first, which cross-links DNA-protein strands in the nuclear gelwork, is easily broken by 1 M NaCl. The second, which binds the DNA molecules end to end to form long strands, is not broken in the initial extract and accounts for the high viscosity. The strands are believed to be the fundamental units of chromosome structure. (auth)

21867

EFFECTS OF X-RADIATION ON MULTIPLICATION AND NUCLEIC ACID SYNTHESIS IN CULTURES OF L-STRAIN MOUSE CELLS. J. F. Whitfield and R. H. Rixon (Atomic Energy of Canada Ltd., Chalk River, Ont.). Exptl. Cell Research 18, 126-37(1959) Aug.

Dilution of cultures of strain-L mouse cells growing in suspension resulted in an immediate cessation of multiplication but did not immediately affect DNA synthesis. During the period of multiplication arrest, DNA per cell reached the double (premitotic) level and DNA synthesis stopped until the cell content of DNA was reduced by the resumption of cell division. This showed that inhibition of division alone may result in inhibition of DNA synthesis when the cell content of DNA reaches the premitotic level. Cell multiplication was twice as sensitive to irradiation as DNA and RNA synthesis. DNA synthesis was slightly less sensitive than RNA synthesis to doses between 0 and 600 r but slightly more sensitive between 600 and 2000 r. A dose of 4000 r permanently stopped cell division but only temporarily inhibited DNA synthesis which resumed only to stop again when the cell content of DNA reached the double (premitotic) level. A dose of 1000 r did not cause an initial lag in DNA synthesis but reduced total DNA synthesis. Reduced DNA synthesis was accompanied by a high concentration of DNA in the cells. It is concluded that DNA synthesis is relatively insensitive to X-rays. The principal effect of radiation is inhibition, or slowing, of cell division. In the absence of cell division DNA synthesis proceeds until the content per cell is doubled and then stops. At very high doses (4000 r), immediate, but temporary, inhibition occurs in addition to later inhibition by attainment of the double or premitotic DNA content per cell. (auth)

21868

EFFECTS OF INTRAUTERINE IRRADIATION IN RATS IN RELATION TO THE STAGE OF EMBRYOGENESIS AT THE TIME OF EXPOSURE. A. Lengerová (Czechoslovak Academy of Sciences, Prague). Folia Biol. (Prague) 3, 321-32(1957).

The author studied the effects of intrauterine irradiation in rats, in relation to the stage of fetal development at the time of exposure. It was found that the degree of damage cannot be regarded as directly proportionate to the degree of radiosensitivity of the embryos at the time of exposure, since on using different criteria (the degree of lethal effect, reduction in body weight, morphological and hematological changes and the ratio of the sexes in the survivors), the maxima and minima of damage did not coincide. (auth)

21869

TRANSMISSIBLE LYSIS OF CELLS OF ESCHERICHIA COLI INDUCED BY X-RAY RADIATION. F. Herčík (Czechoslovak Academy of Sciences, Brno). Folia Biol. (Prague) 2, 327-8(1956).

Preliminary results from 68 experiments indicate that x radiation induces lysis in non-lysogenic strains of E. coli, and that this lysis can be transmitted. (C.H.)

21870

EFFECT OF IRRADIATION DURING EMBRYOGENESIS ON THE RELATIONSHIP BETWEEN THE MATERNAL ORGANISM AND OFFSPRING FROM THE ASPECT OF TISSUE COMPATIBILITY. A. Lengerová (Czechoslovak Academy of Sciences, Prague). Folia Biol. (Prague) 3, 333-7(1957).

A study was made of the effects of intra-uterine irradiation on the relationship between the maternal organism and the offspring, with reference to tissue compatibility. It was found that irradiation on the 15th day of gestation with a dose of 200 r resulted in a large proportion of the offspring developing acquired tolerance to the cells of the mother, as demonstrated by the survival of skin homografts. (auth)

21871

FRACTIONATION OF THE ISOTOPES OF ATMOSPHERIC OXYGEN. A. P. Vinogradov, V. M. Kutyurin, and I. K. Zadorozhnii. Geokhimiya 4, No. 3, 195-205 (1959).

Compared with the oxygen of the hydrosphere and of photosynthesis, atmospheric oxygen has a higher content of O^{18}. For the purpose of explaining this difference, investigations were carried out on the oxygen from the photosynthesis of diatom algae and the freshwater plant Elodea canadensis. The two-beam mass spectrometer MS-2 was used for measurements, and atmospheric oxygen was used as a standard. The results indicate a coefficient of O^{18} enrichment in the atmosphere of 1.018. Moreover, an investigation of fractionation in the soil indicated that a minimum effect ($\alpha = 0.997$) occurred only in the case of considerable humidity. A thorough investigation was carried out on fractionation in the ocean. The samples were collected in the Antarctic Sea; points where samples were taken are shown. Samples were taken from various depths at each place and the variation of the total oxygen and O^{18} content with depth is graphically represented. The fractionation coefficient is 1.010. (TCO)

21872

INVESTIGATIONS OF RADIO-YTTRIUM (Y^{90}) METABOLISM. E. H. Graul and H. Hundeshagen (Philipps-Univ. Marburg/Lahn, Ger.). Intern. J. Appl. Radiation and Isotopes 5, 243-52(1959) July.

The organ distribution of Y^{90} ($Y^{90}Cl_3$) was examined in guinea pigs under various experimental conditions. Special emphasis was put on the inclusion of all organs. A further elucidation of Y^{90} metabolism in regard to the question of structurally differentiated distribution following different methods of administration was achieved by using the radioautographic method of demonstration nd also by using electrophoresis with subsequent registration of activity curves. In surveying the whole complex of our examination results, we see that Y^{90} can by no means be called a bone seeker during the first 8 days, a period which is of great radiobiological importance. Within this period we never find more than 30 per cent of the dose in the skeletal system. On the other hand, there are high specific activities, depending on the method of administration, in the metabolically important organs, such as the pancreas, the hypophyses, and also in the genitals. The radioautographical pictures show that the variations in distribution are the result of the different transport mechanisms. Thus we assume that after intraperitoneal injection transport takes place mainly by way of the lymph. Furthermore, radioautography makes clear the formation of complexes on the part of yttrium and the nucleic acids; the relation between yttrium and the phospholipoids is also confirmed by a closer examination of the individual lipid fractions. From the point of view of radioactive contamination, the accumulation of Y^{90} in the genitals, especially the ovaries, is important. The excretion of the radioisotope which we found in the lung seems to us important in so far as the lung is shown to function as an organ of the reticuloendothelial system; furthermore, the possibility of recontamination in animal experiments must be kept in mind. Thus our distribution studies of Y^{90} produced results which are not only important in the question of incorporation-decorporation, but which also point to further medical and biochemical problems. (auth)

21873

THE EFFECTIVENESS OF ORAL AMMONIUM CHLORIDE ON INCREASED EXCRETION OF RADIOSTRONTIUM IN MAN. Martin L. Charles and Daniel Laszlo (Montefiore Hospital, New York). Intern. J. Appl. Radiation and Isotopes 5, 253-64(1959) July.

The effectiveness of oral ammonium chloride as an agent capable of decreasing body retention of radiostrontium was examined. Strontium-85 was used in these experiments because it is considerably less hazardous than Sr^{90}. Both isotopes share a similar metabolic pattern of behavior. Two patients were studied. One was a 61 year old negro (Patient A) who had had polyneuritis, malnutrition, and mild osteoporosis. He was much improved and ambulatory at the time of these studies. The other patient was a 62 year old white man (Patient B) who had Paget's disease. Both were maintained on a low calcium diet (150 mg a day). In the control study, an intravenous dose of Sr^{85} was administered. Blood, urine, and stool specimens at regular intervals were studied for radioactivity in a scintillation counter. Following an interval, a second study was commenced. In this study 9 g of ammonium chloride in the form of enteric coated tablets were given 1 day prior to administration of the isotope and for 8 days thereafter. In the control study, Patient A excreted in urine 7.8 per cent of the administered dose of the isotope within 24 hr and 32.4 per cent at the end of 14 days. Plasma levels dropped sharply during the first hour following Sr^{85} injection and then declined gradually. Total stool excretion at the end of 14 days was 13.5 per cent. When the patient was given ammonium chloride, his urine contained 14.7 per cent of the administered dose of the isotope in the first 24 hr and 62.3 per cent by the end of the 14th day. Disappearance rate of strontium from plasma was steeper than in the control study. Stool excretion amounted to 11.5 per cent. Hence, with ammonium chloride only 26.2 per cent of the administered dose remained in body tissues as compared to 54.1 per cent in the control study. There was also a very striking increase in calcium excretion in the urine in this latter study. Patient B excreted in urine 4 per cent of the administered dose of the isotope within 24 hr and 13.9 per cent at the end of 12 days. Plasma levels of isotope were lower than that of Patient A by 2-fold. Stool contained 7.4 per cent of the dose. When ammonium chloride was given, this patient excreted in urine 8.4 per cent of the administered dose of Sr^{85} within 24 hr and 38.3 per cent at the end of 12 days. A striking enhancement in urinary calcium was also found in this patient when ammonium chloride was given. Total stool excretion amounted to 8.2 per cent. Hence, with ammonium chloride administration only 54.5 per cent of the administered dose remained in body tissues as compared to 78.7 per cent in the control study. This avidity for Sr^{85} demonstrated in this patient paralleled a similar avidity for calcium. This had been demonstrated prior to these studies by low urinary calcium excretion levels and by retention of a large percentage of a given intravenous test dose of calcium gluconate. When it was discovered that the enteric coated ammonium chloride tablets were responsible for a very large stool excretion of calcium, a third study was carried out using ammonium chloride tablets containing only very small amounts of calcium. Again a very striking enhancement of Sr^{85} and calcium excretion was observed to occur. It is believed that the effectiveness of ammonium chloride in reducing body retention of Sr^{85} results from the metabolic acidosis which mobilizes skeletal calcium and increases renal excretion of calcium and Sr^{85}. In this manner skeletal deposition of the radio-strontium is

decreased. Emphasis is given to the fact that enhancement of Sr^{85} excretion was favored by the early administration of ammonium chloride following a dose of Sr^{85}. That is, when the plasma and soft tissue concentration of this radioactive element were highest and when it was not yet firmly lodged in the skeleton. (auth)

21874

ANALYSIS OF SERUM FROM LETHALLY IRRADIATED MICE TREATED WITH RAT BONE MARROW. Nazareth Gengozian (Oak Ridge National Lab., Tenn.). J. Immunol. 83, 173-83(1959) Aug.

Interfacial tests for rat and mouse serum proteins with specific antiserum reagents on serum samples obtained from lethally irradiated mice 12 to 55 days after RBM treatment showed negative reactions for rat-type protein and positive reactions for mouse-type proteins. Double serum-agar diffusion tests on these same serum samples showed the presence of mouse serum globulins (lipo- and glycoprotein) and the absence of rat serum globulins. Serum A/G ratios of these mice seemed to be correlated with the physical condition of the animal at the time of sacrifice; those in poor condition had a low serum A/G value, but those classified as in good condition had A/G values considerably higher, yet below the normal age controls. The presence of rat-type proteins in the serum of long-term heterologous survivors was induced by exposure to a supralethal x-ray dose. Immunization of long-term heterologous chimeras with sheep RBC antigen resulted in an increase of globulin proteins in the serum of three chimeras, as revealed by paper electrophoresis and biuret tests. Interfacial tests for rat-type protein on these serum samples before and after this immunization were negative, whereas tests for mouse proteins were positive. The data were discussed in terms of the host versus graft destruction hypothesis. (auth)

21875

RELATION OF SECONDARY ANTIGEN INJECTION TO TIME OF IRRADIATION ON ANTIBODY PRODUCTION IN MICE. T. Makinodan, Betsy H. Friedberg, M. Guthrie Tolbert, and N. Gengozian (Oak Ridge National Lab., Tenn.). J. Immunol. 83, 184-8(1959) Aug.

The maximum depression period of the secondary antibody response takes place when antigen is injected 1 day before to 1 hr after x radiation. Recovery of the secondary immune mechanism of irradiated mice takes place within 2 weeks. Above-normal mean total titers were observed when a second antigen injection is given 5 and 10 days after 710 r. No significant decrease or increase in mean peak titer was observed regardless of the x-radiation-secondary antigen injection time relationship. (auth)

21876

EFFECTS OF γ-RADIATION ON THE TASTE AND MANUFACTURING PROPERTIES OF SOFT WHEAT. P. B. Cornwell (Wantage Radiation Lab., Berks, Eng.). J. Sci. Food Agr. 10, 409-12(1959) Aug.

A preliminary study has been made of the effects of three dose levels of γ radiation on the physical, biochemical and baking properties of English wheat. Products made from irradiated grain have been examined for organoleptic changes by a taste panel of selected members. The slight changes induced by irradiation are considered of little commercial significance. (auth)

21877

REMOVAL OF STRONTIUM AND CAESIUM FROM MILK. B. B. Migicovsky (Canada Dept. of Agriculture, Ottawa). Nature 184, Suppl. No. 6, 374-5(1959) Aug. 1.

Experiments with removal of Cs and Sr from milk using Dowex 50W–12 cation exchanger are described. The Ca, K, and Na content was not changed as 86% of the Sr was removed. Flavor was not affected. (T.R.H.)

21878

DETECTION OF FREE RADICALS IN X-IRRADIATED SEEDS OF VICIA FABA BY MEANS OF ELECTRON SPIN RESONANCE ABSORPTION. Walter Klingmüller and Mahesh C. Saxena (Univ. of Southampton, Eng.). Naturwissenschaften 46, 475-6(1959). (In German)

The free radicals in x-irradiated seeds of Vicia faba were determined from embryo, the electron spin resonance absorption. In addition to radicals with plumula, pieces of cotyledon and seed case were also tested. The seeds were irradiated with 10,000 r and cooled with liquid nitrogen. The measurements revealed no detectable radicals in the non-irradiated embryo and cotyledon, but approximately 8×10^{15} radicals/g dry material in the seed case. In the irradiated seeds 7×10^{15} were found in the embryo and cotyledon and 2×10^{16} in the seed cases. The significance of these results is briefly discussed. (J.S.R.)

21879

RADIOSENSITIVITY OF HOMOZYGOTE YEAST CELLS OF VARIOUS PLOIDY TO DENSE IONIZING CORPUSCULAR RADIATION. W. Laskowski (Max-Planck-Institut für vergleichende Erbbiologie und Erbpathologie, Berlin-Dahlem); T. Brustad (Univ. of California, Berkeley); and W. Stein (Freie Universität, Berlin). Naturwissenschaften 46, 498(1959). (In German)

The inactivation degree was determined for four yeast strains of various ploidy after irradiation with a single dose of He^4, Po^{210} alpha particles, C^{12}, and O^{16}. The results showed that for all types of radiation the triploid has the highest resistance, and the tetraploid strain has a higher sensitivity than the diploid strain. The evaluation of the survival rate showed that the increase in sensitivity in the transition from triploid to tetraploid strains reflects the almost sole influence of dominating lethal mutations in these higher ploidy. (J.S.R.)

21880

SIMPLE APPATATUS FOR THE LABELING OF BIOLOGICAL SUBSTANCES WITH GASEOUS TRITIUM. Johannes Pany (Universität, Vienna). Naturwissenschaften 46, 515(1959). (In German)

A simple apparatus for the tritium-labeling of biological substances at normal temperatures and under reduced pressure is described. (J.S.R.)

21881

URANIUM AND SPORE RESPIRATION IN NEUROSPORA SITOPHILA. Vincent W. Cochrane and Dade L. W. Tull (Wesleyan Univ., Middletown, Conn.). Phytopathology 48, 623-8(1958) Nov.

Uranyl nitrate abolishes the uptake of oxygen associated with glucose utilization by conidia of Neurospora sitophila; the approximate ED_{50} is 1.0 μg per 10^5 spores. Endogenous oxygen uptake is not, however, affected by concentrations of uranyl nitrate 30 times as great. In the presence of uranium the respiratory quotient with glucose drops to the endogenous level. Phosphate reverses the uranium effect on glucose respiration. Anaerobic glucose respiration is about 20 times as sensitive to uranium as is aerobic respiration. The oxidation of acetate and ethanol is little affected by uranium at a concentration inhibiting over 80 per cent of glucose

respiration. These effects of uranyl ion on glucose respiration are ascribed to a blocking of the uptake of glucose at or near the surface of the spore. Mercuric chloride at very low concentration inhibits the oxidation of glucose more than it inhibits endogenous respiration, but, unlike uranyl ion, even slightly higher concentrations abolish all respiratory activity. The data in general emphasize that any assay of fungitoxicity based on respiratory responses must take into account the substrate of respiration. (auth)

21882

FREE AMINO ACID LEVELS IN NICOTIANA GLAUCA, N. LANGSDORFFII AND THEIR INTERSPECIFIC HYBRID FOLLOWING GAMMA IRRADIATION. George L. Hagen and James E. Gunckel (Rutgers Univ., New Brunswick, N. J.). Plant Physiol. 33, 439-43(1958) Nov.

Two Nicotiana species and their species hybrid were subjected to varying dosages of gamma-irradiation for a period of two months. By the end of this period leaf abnormalities were evident in all dosages with the N. glauca parent, above 50 r per day in the hybrid and above 150 r per day in the N. langsdorffii parent. In general where leaf abnormalities occurred there was a concomitant increase in the free amino acid content of these leaves. Similarities, both morphological and physiological, to other organisms under stress conditions are discussed. (auth)

21883

A COMPARISON OF THE ACTION OF IONIZING RADIATION AND OF BENZENE ON BONE MARROW HEMOPOIESIS IN RABBITS. L. S. Musikhin (S. M. Kirov Order of Lenin, Military Medical Academy, USSR). Problems Hematol. Blood Transfusion (USSR) (English Translation) 4, No. 2, 39-43(1959).

The qualitative and quantitative changes taking place in the peripheral blood and the bone marrow as a result of P^{32} and Co^{60} radiations are compared. These changes are then compared with the effects of the leukopenic agent benzene. 86 rabbits were irradiated to 600 r by a Co^{60} apparatus, and given subcutaneously injections of P^{32} and of C_6H_6. Leucocyte resistance was followed 7 to 12 weeks. The results are discussed. (T.R.H.)

21884

THE COMBINED EFFECTS OF IONIZING RADIATION AND HIGH TEMPERATURE ON THE LONGEVITY OF THE SPRAGUE-DAWLEY RAT. L. D. Carlson and B. H. Jackson (Univ. of Washington, Seattle). Radiation Research 11, 509-19(1959) Oct.

Male Sprague-Dawley rats, individually caged, were exposed to low-level irradiation with chronic dosages from a Co^{60} source for 16 hours a day. The animals were selected by weight and growth rate and divided into eight groups of 22 rats. Four groups were kept at 28 ± 1°C and were exposed to 0.29, 0.64, 2.60, and 4.18 r/day during the irradiation period, which lasted from 4 months of age to 16 months of age. The other groups were kept at 35 ± 1°C during the period of irradiation, which lasted from 4 months of age to 16 months of age, and were exposed to 0.28, 0.60, 2.57 and 3.96 r/day. At 35°C the ET_{50} for 0.29 r/day was 310; for 0.64 r/day it was 490; for 2.60 r/day it was 540; and for 4.18 r/day it was 510. At 28°C the ET_{50} for 0.28 r/day was 493; for 0.60 r/day it was 510; for 2.57 r/day it was 650; and for 3.96 r/day it was 590. With the exception of the relation between 0.60 and 0.28 r/day, the data are statistically significant at the 5% level. From a previous experiment at 26°C the ET_{50} for 0 r/day was 445, and for 0.8 r/day it was 585. It is suggested that the effects of ionizing irradiation interact with the effects of environment in influencing longevity. (auth)

21885

THE ELECTRON MICROSCOPY OF THE RESPONSE OF FOLLICULAR EPITHELIUM CELLS OF RAT THYROID TO AUTOLYSIS, LIGATION, AND IRRADIATION BY IODINE-131. Henry A. McQuade and Titus C. Evans (State Univ. of Iowa, Iowa City). Radiation Research 11, 520-34(1959) Oct.

Electron and light microscopy were used to study intracellular changes in follicular epithelium cells of rat thyroid after autolysis, in which a lobe was left in a dead animal for a specified time; ligation, in which the inferior thyroid artery supplying the left lobe was tied off and the isthmus severed; and irradiation with intraperitoneally injected radioiodine. Visible responses of follicular cells to autolysis, ligation, and treatment with I^{131} were essentially the same and consisted in alteration of endoplasmic reticulum to spherical vesicles; swelling of mitochondria and their apparent subsequent degradation to lipidlike granules; and the presence of membranelike structures in cell cytoplasm and the follicular lumen. Endoplasmic reticulum of I^{131} treated cells responded before other cytoplasmic components showed any change, however. Autolyzed nuclei were optically lighter after staining than normal nuclei and less electron-dense than nuclei of follicular cells of normal, irradiated, and ligated thyroids. Estimated dosage, time, and effect relationships are given for I^{131} experiments. Treatment with radioiodine resulted in rounding of endoplasmic reticulum in some cells at 24 hours. Two days after such treatment profound intracellular changes were evident. It is suggested that rounding of endoplasmic reticulum and swelling of mitochondria might be attributed to osmotic and surface tension changes within the cytoplasmic environments of these organelles. Mechanisms for the reduction of the endoplasmic reticulum to small spherical vesicles are postulated. It is also suggested that bizarre membranelike structures appearing in a severely injured cells and in the colloid lumen might be the result of fixation and sectioning through unusual liquid interfaces; these interfaces are considered to arise from changes in colloidal systems after destruction of organelles and the presence of debris. (auth)

21886

ACTION OF TRITIATED THYMIDINE ON THE CLONAL GROWTH OF MAMMALIAN CELLS. Ruth M. Drew and Robert B. Painter (Brookhaven National Lab., Upton, N. Y.). Radiation Research 11, 535-44(1959) Oct.

The effect of intracellular incorporation of tritiated thymidine (H^3TDR) on mammalian cell cytology and survival has been investigated by the single-cell plating technique. A survival curve of HeLa S3 cells grown in medium containing H^3TDR has been constructed which demonstrates the lethal action of the radioisotope. At concentrations of 0.1 μc/ml or greater, very few cells survive and continue to divide to form macroscopic colonies in the plate cultures. The lethal action of H^3TDR has been shown to be a function of both the dose and the specific activity. The cytological appearance of the cells is changed as a result of exposure to H^3TDR. Giant cell formation, loosely packed cells, and abortive colonial growth all indicate a radiation effect.

No reversal of the killing effect could be demonstrated when H^3TDR-treated cells were grown over nonmultiplying, x-irradiated feeder cells. (auth)

21887

THE HISTOPATHOLOGY OF DELAYED DEATH IN IRRADIATED MICE TREATED WITH HOMOLOGOUS CELLS. Joanne D. Denko, Eric L. Simmons, and Robert W. Wissler (Univ. of Chicago, Ill.). Radiation Research 11, 557-71(1959) Oct.

To investigate the nature of late deaths that occurred after successful recovery beyond the acute 30-day period, CF No. 1 and DBA/2 female mice were irradiated with 750 r and were given bone marrow cells of the other strain. Surviving mice were sacrificed for histologic study when they appeared moribund. Death could not be ascribed consistently to impaired or arrested hematopoietic function, and no single common histopathologic pattern was found to exist. Rather, the mice seemed weakened and died with a variety of conditions, including pneumonia, necrotizing and infected liver lesions, and rarely with carcinoma or ischemic renal glomerular lesions. The cause of death was not always apparent. (auth)

21888

THE EFFECT OF TOTAL-BODY X-IRRADIATION ON THE DISTRIBUTION OF RIBONUCLEASE ACTIVITY IN SUBCELLULAR FRACTIONS OF RAT SPLEEN. Jay S. Roth and Herbert J. Eichel (Hahnemann Medical Coll., Philadelphia). Radiation Research 11, 572-81(1959) Oct.

In rats given 700 r of total-body x-irradiation, ribonuclease specific activity in spleen homogenates increased twofold, as compared to control samples, 16 hours postirradiation, and returned to the control level 64 hours postirradiation. The distribution of total ribonuclease activity in subcellular fractions of control spleen homogenates was 16.0, 35.7, 20.4, and 28.4% for the nuclear, mitochondrial, microsomal, and supernatant fractions, respectively. Sixteen hours after irradiation, the distribution had changed to 8.7, 29.3, 17.6, and 44.8% for the four fractions, respectively, and at 64 hours it was 4.8, 15.0, 14.1, and 66.0%. The total organ ribonuclease activity 16 hours postirradiation increased 54% over the control level, representing a clear case of enzyme activation at this time period. The considerable change in distribution of total ribonuclease that occurred, which resulted in a great loss of enzyme activity by the particulate fractions and a corresponding gain by the supernatant fraction, is discussed in reference to the behavior of other spleen enzymes after irradiation and in terms of the possible occurrence of spleen ribonuclease in lysosomal particles. (auth)

21889

PROTECTIVE AND THERAPEUTIC EFFECTS OF BACTERIAL POLYSACCHARIDES IN IRRADIATION INJURY IN MICE. Harold Biondal (Univ. of Manitoba, Winnipeg, Can.). Radiation Research 11, 582-6(1959) Oct.

The combination of two bacterial polysaccharides, Piromen and dextran, when they are administered intraperitoneally as two injections, increases the survival in mice receiving 700 r of total-body x irradiation. They are effective when they are administered 24 hours prior to x irradiation and also when they are administered 24 hours after x irradiation. If dextran and Piromen are mixed in vitro and administered as one injection, they are ineffective in modifying the survival of the irradiated mice. (auth)

21890

INTERPRETATION OF SOME RESULTS OF RADIOTHERAPY AND AN ATTEMPT AT DETERMINING A LOGICAL TECHNIQUE OF TREATMENT. J. Bergonié and L. Tribondeau. Radiation Research 11, 587-8 (1959) Oct.

The selective action of x radiation on epithelial tumors, produced by x radiation and on healthy animal tissues is discussed. Reaction mechanisms involved in apparently paradoxical results are discussed. (C.H.)

21891

CHANGES IN THE SHUTTLE-BOX BEHAVIOR IN ALBINO RATS IN RESPONSE TO X-IRRADIATION AT 1 R/min. John E. Overall, Loren C. Logie, and W. Lynn Brown (Univ. of Texas, Austin and School of Aviation Medicine, Randolph AFB, Tex.). Radiation Research 11, 589-99(1959) Oct.

Thirty albino rats were assigned to thirty treatment combinations according to sex differences, brightness contrasts present in shuttle boxes, and x radiation treatments. The proportion of time spent in the darker of two shuttle-box compartments was recorded hourly for 20 consecutive hours. Rats exposed to low-intensity irradiation in either the black only or in both the black and gray compartments spent significantly less time in the black compartment than did nonirradiated controls. Radiation produced a significantly greater change in the behavior of female rats. Radiation resulted in significantly less time in the black where the brightness contrast between compartments was slight than where it was great. When the behavior of rats which could escape from radiation by crossing into the lighter compartment was compared with the behavior of rats which could not escape in this manner, no significant differences were observed. This finding is interpreted as indicating that both groups demonstrated relatively less time in the black as a generalized motor reaction to physiologic changes resulting from the radiation. The fact that rats placed in shuttle boxes which were black on each end escaped from radiation by spending a significant proportion of time in the nonexposed side is interpreted, however, as suggesting an immediate sensitivity to the noxious effects of incident radiation. (auth)

21892

TOXICOLOGIC STUDIES ON POLYPHENYL COMPOUNDS USED AS ATOMIC REACTOR MODERATOR-COOLANTS. Thomas J. Haley, L. E. Detrick, N. Komesu, P. Williams, H. C. Upham, and L. Baurmash (Univ. of California, Los Angeles). Toxicol. Appl. Pharmacol. 1, 515-23(1959) Sept.

A study has been made of certain aspects of the toxicology of organic polyphenyl compounds proposed for use as moderator-coolants in atomic reactors. Only monoisopropylbiphenyl, irradiated monoisopropylbiphenyl, and terphenyl mixtures (OMRE) were irritating to the conjunctiva in rabbits and only the unirradiated moderator-coolants caused skin irritation in rabbits. Both the moderators and their components were highly damaging to guinea pig skin following intracutaneous injection. All the polyphenyl compounds except irradiated monoisopropylbiphenyl produced sensitization and chemical necrosis. The latter produced only necrosis. Monoisopropylbiphenyl and o- and m-terphenyl were the only polyphenyls that caused death after inhalation, al-

though all of the compounds produced some of the following symptoms: nasal congestion with rhinitis, lachrymation, labored respiration, and erythema of the ears and paws. The following histopathologic changes were also observed: acute tracheal necrosis, acute tracheobronchitis, pulmonary edema, bronchopneumonia, atelectasis, and petechial hemorrhages. All such toxic effects can be prevented by protective clothing and respirators. (auth)

21893

LIMITATIONS OR WHOLE-BODY IRRADIATION FOR INDUCING ACCEPTANCE OF HOMOGRAFTS IN CASES INVOLVING A GENETIC DEFECT. Seldon E. Bernstein, Elizabeth S. Russell, and Fay A. Lawson (Roscoe B. Jackson Memorial Lab., Bar Harbor, Me.). Transplantation Bull. 24, 106-8(1959) July.

Experiments are described and discussed in which normal isologous and homologous hematopoietic tissue implants in genetically anemic mice were exposed to various doses of x rays. The findings suggest considerable limitation to the use of radiation in inducing acceptance of homografts in mice or humans with specific genetic defects. (T.R.H.)

21894

APPLICATIONS OF (d,p) REACTION IN NUCLEAR EXCITATION WITH LARGE SPINS. V. G. Neudachin, I. B. Teplov, and A. F. Tulinov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 548-50(1959) Aug. (In Russian)

An application of (d,p) reaction for exciting nuclear states with large spins in light nuclei is suggested. It is shown that in addition to single-particle lead excitation, it is possible to segragate these levels from the others due to their peculiar angular distribution. Calculations were made of the angular distribution of protons produced by the knock-out process in reactions $B^{10}(d,p)B^{11^*}$ ($E_{excit} = 2.14$ Mev, $J^* = \frac{1}{2}^-$) for which an ordinary stripping is forbidden. The computation was made for deuteron energies $E_d = 4$, 8, and 12 Mev. ($R = 4.8 \times 10^{-13}$ cm). The plotted graphs show that the maximum curve for the ordinary stripping is narrower than in knock-out processes. The knock-out process is considerably more sensitive to Coulomb field than the ordinary stripping process, which is shown for 8 Mev in the reaction $Mg^{24}(d,p)Mg^{25^*}$. (R.V.J.)

21895

BIOLOGICAL AND ENVIRONMENTAL EFFECTS OF NUCLEAR WAR. SUMMARY-ANALYSIS OF HEARINGS, JUNE 22-26, 1959, JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, AUGUST 1959. Washington, D. C., Joint Committee on Atomic Energy, 1959. 58p. (GPO)

A hypothetical nuclear attack is described and discussed. Estimates of casualties and damage to dwellings are made and the biological effects of blast, heat, and radiation are pointed out. The effects of environmental contamination on animals and food supplies are described, and additional data on fallout are given. Information on survival measures and strategic implications is included. (T.R.H.)

21896

THE RADIOPROTECTIVE PROPERTIES OF CYSTEINE-HCl, CYSTEAMINE HCl, AND CYSTEAMINE-2HCl WHEN TESTED ON CHICK FIBROBLASTS IN VITRO. Per Oftedal, Reidar Oftebro, and Reidar Eker (Norsk Hydro's Inst. for Cancer Research, Oslo). p.225-44 of "25th Anniversary Publication from the Norwegian Radium Hospital." Oslo, H. Aschehoug and Co. (W. Nygaard), 1958. 323p.

Two series of experiments are described and their results discussed. Both deal with the possible modification by SH containing compounds of the radiation effect on chick fibroblasts in vitro. Heart fibroblasts from 9-day old chick embryos were used throughout. They were cultured either in hanging drops or in Carrel flasks. Cysteine-HCl, cysteamine-HCl or cystamine-2HCl in several different concentrations was added to the cultures shortly before irradiation with 175 kv x rays (0.5 mm Cu filtration). Subtoxic levels determined by mitotic counts on hanging drop cultures were found to be 0.21 mM cysteine-HCl, 0.34 mM cysteamine-HCl, and 0.44 mM cystamine-2HCl. The mitotic inhibition after irradiation with 200 r was found not to be lessened by cysteine or cystamine. (Cysteamine was not tested.) In most growth and survival experiments the cultures were started and treated in Carrel flasks, and higher concentrations of test substances were used. After 1500 and 2000 r and 0.89 mM cystamine-2HCl it was found that the cultures lived longer and showed better growth than did the controls. This difference becomes apparent 5 to 7 passages after treatment. Experiments with cysteine and cysteamine show, as far as they go, no such effect. The differences observed may be explained either as caused by a special radioprotective mechanism, active during irradiation, or as a general growth promoting property of cystamine. (auth)

21897

ON THE CONSTANCY OF THE RELATIVE BIOLOGIC EFFICIENCY OF β-PARTICLES DURING SPERMIOGENESIS IN DROSOPHILA MELANOGASTER. Jeanne Mossige and Per Oftedal (Norsk Hydro's Inst. for Cancer Research, Oslo). p.245-52 of "25th Anniversary Publication from the Norwegian Radium Hospital." Oslo, H. Aschehoug and Co. (W. Nygaard), 1958. 323p.

An apparatus for external irradiation of flies with β particles from a solution containing radioactive isotopes is described, and the biologic dosimetry of the source is reported. The apparatus has been used for obtaining the sex-linked recessive lethal mutation curve after irradiation with P^{32} β particles, using a dose biologically equivalent to 930 r for the induction of dominant lethals in mature sperm. The curve was found similar to the one obtained after 1000 r of x rays. (auth)

21898

THE ROLE OF MIXED DISULPHIDES IN CHEMICAL PROTECTION AGAINST IONIZING RADIATION. Lorentz Eldjarn and Alexander Pihl (Norsk Hydro's Inst. for Cancer Research, Oslo). p.253-88 of "25th Anniversary Publication from the Norwegian Radium Hospital," Oslo, H. Aschehoug and Co. (W. Nygaard), 1958. 323p.

The findings that the protective SH compounds form mixed disulphides with tissue constituents has renewed the interest in the role of sulphur groups in radiobiology. Recent evidence, as summarized above, indicates a unique role of SS groups in protection against radiation damage. A new hypothesis for the protective action of compounds of the cysteine-cysteamine group has been formulated, a theory which attempts to account for chemical protection against direct as well as indirect action of ionizing radiation. The mixed disulphide hypothesis is supported by chemical, radiochemical, and biochemical observations recently made in this laboratory. It is consistent with a considerable body of available data on the relationship between chemical

structure and protective ability. The theory has also received strong support from biophysical studies obtained in other laboratories. On the basis of the mixed disulphide hypothesis, suggestions have been made as to the chemical nature of the target molecules of cells and tissues. It appears likely that the target molecules, in the vicinity of accessible SH or SS groups, carry negatively charged groups (carboxyl, phenol, or hydroxyl groups), capable of forming hydrogen bonds with the amines of the protector. The target molecules most probably belong to the enzymatic systems of the cells. Possibly they are co-enzymes occurring in minute amounts. The mixed disulphide hypothesis has served as a fruitful guide in the design of experiments. The theory offers a logical approach to the search for new x-ray protective as well as sensitizing agents. In this pursuit cysteine derivatives, in which the amine function is covered, would be expected to resemble more closely the target molecules of cells and tissues. (auth)

21899

A 50 CURIE URANIUM–TUNGSTEN ALLOY SHIELDED Cs^{137} PLESIOTHERAPY UNIT. Johan Baarli and Tor Brustad (Norsk Hydro's Inst. for Cancer Research, Oslo). p.307-15 of "25th Anniversary Publication from the Norwegian Radium Hospital." Oslo, H. Aschehoug and Co. (W. Nygaard), 1958. 323p.

The physical properties of Cs^{137} are discussed with special emphasis on plesiotherapeutic application. Details of a new design of a 50 curie uranium tungsten alloy shielded therapy unit under construction have been given. Its main advantages are a high degree of mechanical flexibility, the two independent treatment ports, and that it is applicable down to a focus-skin distance of 4 cm. Estimated dose rate at 5 cm is 70 r/min. (auth)

21900

DOSIMETRIC SYSTEMS FOR X- AND γ-RAYS. Tor Brustad and Johan Baarli (Norsk Hydro's Inst. for Cancer Research, Oslo). p.317-23 of "25th Anniversary Publication from the Norwegian Radium Hospital." Oslo, H. Aschehoug and Co. (W. Nygaard), 1958. 323p.

A review of 6 different dosimetric systems studied at Norsk Hydro's Institute for Cancer Research is presented. These systems are the following: creation of F-centers in KBr, oxidation of ferrous ions to ferric ions in aqueous solution, colorization of Zn, Sb, Pb (activated) soda glass, capacity changes in dielectrica, ionization chambers, and anthracene scintillation dosimeter. As radiation sources a 31 Mev betatron, 220 kev and 35 kev x-ray units have been employed. (auth)

21901

RADIATION BIOLOGY AND CANCER. A Collection of Papers Presented at the Twelfth Annual Symposium on Fundamental Cancer Research, 1958. Austin, Tex., University of Texas Press, 1959. 498p.

Topics discussed at this symposium include radiation neoplasia and endocrine systems, fundamental radiobiology, radiological applications, radiation effects on the hematopoietic system, the induction of neoplasia by ultraviolet light, the induction of neoplasia by ionizing radiations, radiation biology and cancer, and medical applications of radiation. Complete subject and author indexes are included. Separate abstracts have been prepared on each paper. (C.H.)

21902

RADIATION NEOPLASIA AND ENDOCRINE SYSTEMS. Jacob Furth (Harvard Univ., Boston and New England Deaconess Hospital, Boston). p.7-25 of "Radiation Biology and Cancer."

Neoplasia is defined as a state of apparently unrestrained growth due to permanent alteration in the cell, such as mutation or abnormal differentiation, or by extracytogenic forces, such as feed-back derangement or virus. Evidence is presented pointing to the importance of both irreversible herditary alterations in cells and indirect hormonal effects as the most powerful factors in the induction of neoplasms by radiation. Radiation effects on three pituitary-target systems in mice are considered as examples. It is emphasized that extrapolations from animal studies to man are not warranted. (C.H.)

21903

PRIMARY PHYSICAL AND CHEMICAL PROCESSES IN RADIOBIOLOGY. P. Howard-Flanders (Univ. of California, Berkeley). p.29-40 of "Radiation Biology and Cancer."

Experiments of two kinds may help to elucidate primary events in the biological action of radiation. The first is the study of the relative biological effectiveness of radiations of different quality, such as x rays and fast neutrons. The second is the study of the action of dissolved substances on the sensitivity to radiation. Examples discussed include the oxygen effect on the radiosensitivity of cells; the kinetics of the reaction with oxygen; the hypothesis that the oxygen dependent injury is associated with a carbon radical; the life time of the oxygen dependent injury; similarities in the action of nitric oxide and oxygen in radiation biology; injury by multiple ionization; and linear energy transfer spectra of ionizing radiations. (C.H.)

21904

THE INFLUENCE OF OXYGEN UPON THE RADIATION DAMAGE OF LYSOZYME. R. J. Shalek and T. L. Gillespie (Univ. of Texas, Houston). p.41-50 of "Radiation Biology and Cancer."

In the irradiation of dry lysozyme by cobalt-60 gamma radiation in the presence of one atmosphere of oxygen, only 0.55 as much dose was required to produce the same reduction in enzymatic activity as in the presence of one atmosphere of nitrogen. In dilute solutions of lysozyme, the absence of oxygen did not influence the yield. Data are tabulated. Two possibilities are discussed for the explanation of the oxygen effect on dry enzymes. (C.H.)

21905

THE EFFECT OF RADIATIONS OF DIFFERENT ION DENSITIES ON THE GERM CELLS OF DROSOPHILA VIRILIS. Mary L. Alexander (Univ. of Texas, Houston). p.51-70 of "Radiation Biology and Cancer."

Studies of the radiation damage in cells undergoing spermatogenesis in Drosophila virilis showed quantitative and qualitative differences from radiation treatment. The biological damage from radiation was found to depend on a number of factors including the physical characteristics of the radiation and the interaction of the radiations with the biological system. An inverse relationship was found for the amount of lethal damage and the ion density of the radiation in meiotic and spermatogonial cells. Environmental changes were found to enhance or suppress biological damage to a greater degree with x rays than with neutrons. Data are presented from a series of studies on dominant lethal and translocation damage in spermatogenesis; radiation damage with 200 kv x radiation, 1.71 and 1.33 Mev

gamma rays, and 22 Mv x radiation; the effects of fast neutrons on gametogenesis; and the influence of environmental factors on radiation damage. (C.H.)

21906

THE PATHOLOGICAL EFFECTS OF RADIATION INJURY. Simon Koletsky (Western Reserve Univ., Cleveland). p.71-89 of "Radiation Biology and Cancer."

An important factor governing injury from radiation lies in the sensitivity of the tissues affected. Factors affecting radiation injuries are discussed. The histological characteristics of radiation injuries are described for various tissues. (C.H.)

21907

EFFECT OR IRRADIATION ON NEOPLASTIC CELLS (RADIOSENSITIVITY). T. C. Evans (State Univ. of Iowa, Iowa City). p.90-102 of "Radiation Biology and Cancer."

Results are reported from a series of in vitro and in vivo studies on the relative radiosensitivity of neoplastic cells under various conditions. Data are presented from preliminary experiments using two strains of ascitic tumor cells in the mouse. Dose-effect curves were established for each of the two strains and their relative radiosensitivity was determined under a variety of conditions. Results are discussed. The importance of the genetic make-up of the tumor host on radiosensitivity of tumors is stressed. (C.H.)

21908

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF 22 MVP X-RAYS, COBALT-60 GAMMA RAYS AND 200 KVP X-RAYS DETERMINED FROM THE LD_{50} IN MICE. W. K. Sinclair and L. H. Blackwell (Univ. of Texas, Houston). p. 103-20 of "Radiation Biology and Cancer."

Determinations of the RBE of 200 kvp x rays 1.4 mm Cu HVL, cobalt-60 γ rays, and 22 Mvp x rays from a betatron have been made using mouse LD_{50} as the criterion with consideration of the mean killing time and weight changes of the mouse to indicate qualitative differences. A specially constructed exposure arrangement was designed to provide uniform dose throughout each of the eight animals irradiated at one time, when two parallel opposing fields of radiation were applied from each beam. The absorbed dose is estimated from the average elementary components of the animal. Four separate experiments involving simultaneous irradiation of C3H mice on each of the three radiation machines and following the animal for thirty days were carried out. The results were analyzed by linear plots and by Litchfield and Wilcoxon analysis, with good agreement. The RBE for cobalt-60 versus x ray was found to be 0.86, for betatron versus x-ray 0.82, and for betatron versus cobalt-60, 0.95. The difference between 200 kvp x rays and the two supervoltage radiations is believed highly significant, while the two supervoltage radiations may differ, but only slightly, from one another. It is pointed out, however, that the quantitative result could be varied (by means of the absorbed dose estimate) if different critical tissues are chosen. (auth)

21909

IRRADIATION OF CELLS IN TISSUE CULTURE. A Specialized, Fast Neutron Facility and Preliminary Results on the Relative Biological Effect of Neutron Versus Gamma Irradiation on Cells in Vitro. C. M. Pomerat, L. C. Logie, and Y. H. Nakanishi (Univ. of Texas, Galveston and U. S. Air Force, Austin, Tex.). p.121-45 of "Radiation Biology and Cancer."

A facility is described for the delivery of moderate doses of PoBe fast neutrons to cells in tissue cultures. Procedures used in dosimetry are discussed. In an effort to contrast gamma radiation injury against a given neutron dosage, a series of cultures were followed with still photomicrographs and time-lapse cinematography during the first and second weeks and after fixation and straining twelve days post-irradiation. Selected examples are reproduced. Significant morphological findings on human amnion cells are reported and observations are compared with those on sister cultures exposed to gamma radiation. The data presented illustrate methods of making direct observations on the activity of irradiated living human cells under highly controlled conditions. (C.H.)

21910

THE USE OF THE FERROUS SULFATE DOSIMETER FOR X-RAY AND GAMMA RAY BEAMS. R. J. Shalek and W. K. Sinclair (Univ. of Texas, Houston). p. 149-62 of "Radiation Biology and Cancer."

Experimental G values for the oxidation of ferrous sulfate by radiation for 200 kvp x-rays, cobalt-60 rays, and 22 Mvp x-rays are 14.6 ± 0.4, 15.8 ± 0.5, and 15.5 ± 0.5 ferric ions per 100 ev. Curves relating G value to effective photon energy, effective photon energy to half value layer, and absorption of energy to photon energy are presented together with formulas for the calculation of absorbed dose from optical density determinations. (auth)

21911

INTEGRAL DOSE AND SOURCE SIZE IN COBALT-60 TELETHERAPY. W. K. Sinclair and W. V. Breazeale (Univ. of Texas, Houston). p. 163-74 of "Radiation Biology and Cancer."

Mathematical expressions for the total energy flowing through a diaphragm, the fraction of this dissipated in the beam, and that dissipated in the penumbra are given. The variation of these quantities with the parameters of source size, source-skin distance, field size, and diaphragm distance are discussed. The formulas have been tested by measurements with a ferrous sulfate dosimeter of the energy dissipated in the umbra, penumbra, and the total-body when a field is applied to a polyethylene phantom man. Good agreement has been demonstrated between calculated and measured values for three combinations of diaphragm-skin and source-skin distances for a field of moderate size. The energy dissipated in the body and the amount lost outside it for these circumstances has also been estimated. (auth)

21912

DOSIMETRY OF INTERSTITIAL NEEDLES OF RADIUM, COBALT-60 AND CESIUM-137. W. K. Sinclair, J. B. Blizard, B. J. Comstock, and G. H. Fletcher (Univ. of Texas, Houston). p. 175-89 of "Radiation Biology and Cancer."

The dosimetry of steel-sheathed cobalt-60 and cesium-137 needles has been studied and compared to platinum-sheathed radium needles. Methods of physical dosimetry included photographic film, calculation, and scintillation crystal techniques. Biologically, the isotopes have been compared by the erythema produced by surface plaques on rabbit skin. The clinical effects of inhomogeneity of radiation distribution, area of radiation, duration of exposure, and secondary beta radiation have been studied. Data are summarized. (C.H.)

21913

HEMATOLOGICAL EFFECTS OF IRRADIATION.

Leon O. Jacobson (Argonne Cancer Research Hospital, Chicago and Univ. of Chicago). p.193-202 of "Radiation Biology and Cancer."

Factors involved in the recovery of hematopoietic tissue from radiation injury are discussed. Findings are reviewed from studies on the effects of spleen-shielding, spleen or embryo transplants, and injections or transplantation of isologous tissues of hematopoietic origin on the recovery of irradiated rodents. Evidence that injected cells of isologous, homologous, or heterologous origin colonize lethally-irradiated rodents and enhance subsequent survival is reviewed. Various aspects of recovery from radiation injury are discussed. The author states that he adheres to the concept that a humoral factor is involved, especially in the immunologic interreactions that ensue. Observations on late death of irradiated animals given heterologous material are reviewed. (C.H.)

21914

PROTECTION BY BONE MARROW AGAINST THE EFFECT OF URETHAN. Sadahisa Kawamoto (Univ. of Texas, Houston). p. 203-10 of "Radiation Biology and Cancer."

The present experiments demonstrate that urethan augments the lethal effects of x-irradiation in mice. When urethan is given together with x rays to thigh-shielded mice, marrow-shielding does not fully protect. When marrow transfusions are given in addition, they survive, indicating protection against the radiomimetic effects of urethan. (auth)

21915

CONSEQUENCES OF BONE MARROW INDUCED RADIATION RECOVERY. John J. Trentin (Baylor Univ., Houston, Tex. and Univ. of Texas, Houston). p.211-22 of "Radiation Biology and Cancer."

Mammals of several species can be protected against otherwise lethal doses of whole-body irradiation by the postirradiation transfusion of bone marrow, or hematopoietically active spleen, or fetal liver. This protection is associated with the reseeding and repopulation of the otherwise depleted or destroyed hematopoietic system with cells of the injected bone marrow, spleen, or fetal liver. This is true regardless of whether protection is achieved with isologous, homologous, or heterologous sources of hematopoietic tissue, and protection can be achieved between closely related species such as with rat tissues injected into mice. In animals protected with homologous or heterologous bone marrow there is induced tolerance not only to the transplanted hematopoietic elements but also to skin grafts from the marrow donor. Sufficiently high doses of irradiation were found to wipe out the normal hematopoietic system of an animal and the hematopoietic system of the donor was substituted. Possible applications in the therapy of leukemia are discussed. When protection against lethal doses of radiation in mice was achieved with homologous or heterologous bone marrow, although the initial irradiation effect is overcome and there is reseeding and repopulation, a secondary disease develops which may result in the death of the animals during the second month postirradiation. The nature of this disease is discussed. (C.H.)

21916

THE POTENTIALITIES OF TISSUE CULTURED CELLS OF HEMIC ORIGIN IN X-IRRADIATED MICE. Daniel Bilien (Univ. of Texas, Houston). p. 233-37 of "Radiation Biology and Cancer."

The results of studies on the effectiveness of tissue cultured bone marrow cells in reversing x-irradiation death in recipient isologous mice are reported. The most successful prolongation of effective cells in vitro occurred under suboptimal conditions of growth. Thus using the vaccine vial suspension method of tissue culture and incubation at 25°C, effective cells were maintained for 24 days. When the tissue culture method was such that conditions of metabolism and growth were improved (well method, 37°C), then effective cells disappeared in about a week's time. Altered cell lines originally obtained from normal bone marrow explants lacked protective activity in lethally irradiated mice. In addition, such cells produced tumors in recipient irradiated animals protected with fresh bone marrow. Animals completely protected with isologous marrow appear to be more resistant to tumor production by these altered cells than those recipients afforded homologous treatment. A tentative analysis of the cells present in cultures has been made. The implications of these results in regard to the mechanism of bone marrow protection are discussed. (auth)

21917

STUDIES ON THE INTERRELATIONS OF RNA, DNA AND PROTEIN SYNTHESES IN THE PROCESS OF ULTRAVIOLET-INDUCED MUTAGENESIS. Felix L. Haas and Charles O. Doudney (Univ. of Texas, Houston). p.241-56 of "Radiation Biology and Cancer."

Results of studies on Escherichia coli indicate that the principal mutagenic effect of ultraviolet radiation is modification of nucleic acid precursors present in the cell during irradiation. Nucleic acid macromolecules present at the time of irradiation were relatively impervious to modifications resulting in types of mutation studied. It was concluded that the modified precursors were stabilized by the presence of amino acids until used in gene synthesis. If stabilization is prevented, the mutagenic precursors are rapidly removed by some enzymatic process. The possibility is discussed that concurrent synthesis of RNA and protein is immediately involved in mutation fixation, and that mutation results from incorporation of modified precursors into RNA rather than DNA. It is postulated that since RNA and protein syntheses are involved in DNA replication, perhaps changes in RNA specificity result in corresponding changes in genetic DNA. It is considered possible that abnormal purines and pyrimidines produced in vivo by various means affect the genetic mechanism of dividing somatic cells so as to produce mutations resulting in neoplastic growth. (C.H.)

21918

STUDIES OF THE MECHANISM OF ACTION OF ULTRAVIOLET IRRADIATION IN INITIATING TUMORS IN THE LUNG TISSUE OF MICE. Stanfield Rogers (Univ. of Tennessee, Knoxville). p.257-75 of "Radiation Biology and Cancer."

The in vitro induction of pulmonary adenomas by exposure of fetal mouse lung to ultraviolet radiation is reported. Mechanisms involved in the carcinogenic effect are discussed. Data are reported on the effects of intensity and duration of exposure, temperature at the time of irradiation and after exposure, and the influence of embryonic development and state of cell division upon the initiatory response. Results indicate that the action of ultraviolet radiation in initiating neoplastic change in pulmonary cells is directly upon the heredity-determining mechanism responsible for

the continuing neoplastic state of the tumor cells rather than through a chain of chemical intermediates. Results are compared with data obtained in studies of tumors activated by viruses, nitrogen mustard, and urethan. Similarities in the initiation of mutation and in the initiation of neoplastic change and the influence of a defect in nucleic acid synthesis, most probably desoxyribonucleic acid, are discussed. (C.H.)

21919

FACTORS AFFECTING THE INDUCTION OF CANCER BY ULTRAVIOLET LIGHT. A. Clark Griffin, M. A. O'Neal, and R. Hakim (Univ. of Texas, Houston). p.276-85 of "Radiation Biology and Cancer."

Results are reported from a series of experiments on the effects of various chemical compounds on ultraviolet carcinogenesis. One of the first considerations was the determination of the specific part of the ultraviolet spectrum involved in carcinogenesis. It is reported that the cancer spectrum for man has been established to fall between 2900 to 3400 A, with the mid-ultraviolet being the most effective. The cancer spectrum for mice was found to fall within 3000 to 4000 A. Results are reported from a study of the effects of specific chemical substances on ultraviolet cancer induction in mice. Data are included on the effects of psoralen compounds, benzophenone derivatives, p-aminobenzoic acid, and a solvent oil fraction. Possible reaction mechanisms involved in the action of psoralen compounds in either promoting or delaying cancer induction under one set of conditions, and in the activation of harmless regions of the ultraviolet spectrum to produce the most severe erythemal and carcinogenic response are discussed. (C.H.)

21920

RADIATION-INDUCED LEUKEMIA IN MICE: A PROGRESS REPORT. Henry S. Kaplan (Stanford Univ., San Francisco). p.289-302 of "Radiation Biology and Cancer."

Some of the factors which affect the radiation induction of lymphocytic neoplasms in mice are discussed. Susceptibility was found to be influenced by such general factors as strain, sex, and dose of the inducing agent. Other factors which were investigated include hormonal factors; the role of the thymus; the role of the bone marrow; the possible activation of a latent filterable agent by irradiation or other exogenous agents; the question of reversibility of the neoplastic transformation; and the modifying effects of certain biochemicals. (C.H.)

21921

RELATION OF RADIATION CARCINOGENESIS TO CARCINOGENESIS INDUCED BY OTHER MEANS. Arthur Kirschbaum (Baylor Univ., Houston, Tex. and Univ. of Texas, Houston). p. 303-9 of "Radiation Biology and Cancer."

Urethan potentiates the induction of mouse leukemia by x rays, estrogenic hormone, or methylcholanthrene. This suggests a phase common to all three modes of leukemogenesis. Irradiation of the mouse ovary renders it susceptible to the tumor-promoting action of gonadotrophic hormone. During a relatively long period of suppression, the irradiated ovary retains its ability to respond to the promoting action of gonadotrophin. (auth)

21922

INDUCTION OF LEUKEMIA IN MAN BY RADIATION. William Curry Moloney (Tufts Univ., Boston and Boston City Hospital). p.310-21 of "Radiation Biology and Cancer."

The inadequacies of the present day information on radiation-induced leukemia in man are pointed out. The variety of biological and other factors which make analysis of acceptable data difficult are discussed. It is apparent that large doses of radiation are leukemogenic and chronic, lower level exposure has constituted an occupational hazard in radiologists and physicists. The prevalence of acute and chronic myelogenous leukemia has been noted in both irradiated Western as well as Japanese populations. The lack of chronic lymphatic leukemia suggests that this form of the disease may not be induced by ionizing irradiation in man. With the acquisition of better information on radiation dose, as well as improved hematological and clinical data, more light may be shed on the relationship of radiation to the type of leukemia, length of the latent period, and the pathogenesis of disease. To this end large scale surveys on various irradiated individuals should be carried out and some method of international registration of adequate radiological, hematological, and clinical data should be established. (auth)

21923

INDUCTION OF TUMORS WITH INTERNALLY ADMINISTERED ISOTOPES. Miriam P. Finkel (Argonne National Lab., Lemont, Ill.). p.322-35 of "Radiation Biology and Cancer."

Tumors can be produced with great facility by administering radioactive isotopes in proper form, location, and dosage. In terms of injected dose per body weight, the alpha emitters are more potent skeletal carcinogens than the beta emitters, and energic beta rays are more potent than weak beta rays. The biological half time, which depends both upon physical half life and upon retention in the body, is another important factor in carcinogenicity. In addition, those isotopes with decay schemes that include subsequent radiations appearing in a short period of time display enhanced effectiveness. All of these factors influence dose rate and total integrated dose at the site of tumor origin. The latent period between isotope administration and bone tumor induction appears to be independent of dose, independent of isotope, and independent of age. There is increasing evidence that it is also independent of species. None of the animal data support the hypothesis that the carcinogenic effect increases linearly with dose and that it has no threshold. On the contrary, these data point out the dangers of extrapolating through untested areas from data that include only a small range of doses. (auth)

21924

RADIATION-INDUCED NEOPLASMS IN MAN. C. Lenore Simpson (Roswell Park Memorial Inst., Buffalo). p.336-46 of "Radiation Biology and Cancer."

Results are reported from a statistical survey on the incidence of tumors in children who had received irradiation of the thymus. Data are tabulated. Difficulties involved in a retrospective study on a human population are discussed. (C.H.)

21925

MUTAGENESIS AND CARCINOGENESIS. Walter J. Burdette (Univ. of Utah, Salt Lake City). p.349-58 of "Radiation Biology and Cancer."

Germinal mutation has provided a large number of genes for tumor susceptibility. Somatic mutation of chromogenes as an immediate antecedent of the neo-

plastic change within a somatic cell must be admitted as a possible cause of cancer, but no proof that this is commonly the reason for the transformation of normal to neoplastic cells is currently available. Investigation of germinal mutants for susceptibility provides a useful method for understanding the pathogenesis of neoplastic disease. (auth)

21926

RADIATION STUDIES ON LYSOGENY AND TUMOR VIRUSES. Harry Rubin and Howard M. Temin (California Inst. of Tech., Pasadena). p.359-81 of "Radiation Biology and Cancer."

Data are presented from a series of studies on the capacity of Escherichia coli to support the multiplication of various phages after exposure to x ultraviolet radiations. The problem of genetic interaction between tumor viruses and host cells was also investigated quantitatively with primary cultures of chick embryo cells infected with virus. The in vitro assay method was used to study the inactivation by radiation of Rous sarcoma virus and of the capacity of cells to support the growth of this virus. The relative sensitivity of the virus studied to x radiation and ultraviolet radiation was measured. It was concluded that, since the genetic information of the virus is probably incorporated into the host genome, the latter is modified in a manner which cannot be distinguished from a mutation. If true it would seem that there is little fundamental difference operationally between the somatic mutation and virus theories of cancer etiology. (C.H.)

21927

THE ROLE OF VIRUSES IN X-RAY INDUCED LEUKEMIA. Leon Dmochowski, Clifford E. Grey, and Ludwik Gross (Univ. of Texas, Houston; Baylor Univ., Houston, Tex.; and Veterans Administration Hospital, Bronx, N. Y.). p.382-99 of "Radiation Biology and Cancer."

The results are presented of an electron microscope study of thin sections of organs of C3HBi strain mice with certain types of leukemia. Two types of leukemia investigated include leukemia induced by x-irradiation and by cell-free preparations from leukemic organs of C3HBi mice with x-ray induced leukemia. In various organs from mice with both types of leukemia, changes characterized by the same pattern of cellular destruction have been observed. These changes have been found similar to those observed in the organs of AKR and C58 strain mice with spontaneous leukemia and of C3HBi mice with leukemia induced by cell-free preparations from organs of leukemic AKR or C58 strain mice. Virus-like structures have been found in C3HBi strain leukemia induced by cell-free material from C3HBi x-ray induced leukemia, but not in the latter. These particles are smaller than those observed in spontaneous leukemia of AKR and C58 strain mice or those found in C3HBi strain mice with leukemia induced by cell-free preparations of AKR or C58 leukemic organs. The significance of these findings as applied to the origin of different types of leukemia in mice is discussed. (auth)

21928

THE USE OF X-IRRADIATION AND/OR CORTISONE TO CONDITION HOSTS FOR GRAFTING. Helene Wallace Toolan (Sloan-Kettering Inst. for Cancer Research, New York). p. 400-8 of "Radiation Biology and Cancer."

Results are reviewed from a number of studies on the effects of x radiation and cortisone treatment on the response of animals to foreign tissue grafts. Possible reaction mechanisms involved are discussed. (C.H.)

21929

CARCINOGENESIS OF CHRONIC GAMMA IRRADIATION. Joanne Hollcroft (National Cancer Inst., Bethesda, Md.). p.409-22 of "Radiation Biology and Cancer."

Results are reviewed from a number of recent studies on the biological effects of chronic gamma irradiation. Emphasis is placed on mechanisms involved in carcinogenesis. (C.H.)

21930

RADIATION AND HUMAN GENETICS. W. J. Schull (Univ. of Michigan, Ann Arbor). p.423-39 of "Radiation Biology and Cancer."

The genetic risks to mankind accruing from exposure to ionizing radiation are reviewed. Topics discussed include the current rate of exposure to ionization radiations in the United States, available information on the mutagenic effect of radiation, and difficulties in extrapolating from experimental evidence on laboratory animals to human populations. (C.H.)

21931

STUDIES OF THE ANEMIAS ASSOCIATED WITH CHRONIC LYMPHOCYTIC LEUKEMIA AND HODGKIN'S DISEASE USING Fe^{59} AND Cr^{51}. Daniel E. Bergsagel and P. Pikouli Giannopoulos (Univ. of Texas, Houston). p.443-55 of "Radiation Biology and Cancer."

Mechanisms involved in the anemias associated with chronic lymphocytic leukemia and Hodgkin's disease were investigated in human subjects with the aid of iron-59 and chromium-51. Data are tabulated on red cell survival and iron turnover, the plasma iron and unsaturated iron-binding capacity in Hodgkin's disease, and the effect of prednisone therapy on the anemia of chronic lymphatic leukemia. Factors affecting the shortening of the life span of erythrocytes observed in many cases of leukemia are discussed. (C.H.)

21932

THE INTRACAVITARY USE OF RADIOACTIVE COLLOIDAL GOLD. Carlo A. Cuccia, Wayne Schultz, and Raymond G. Rose (Univ. of Texas, Houston). p.456-71 of "Radiation Biology and Cancer."

The results obtained in 137 patients given 186 intracavitary treatments of radioactive colloidal gold are reviewed. No conclusions can be drawn as yet in a series of twelve patients given Au^{198} prophylactically for ruptured malignant ovarian cysts or in seven patients with diffuse cancerous peritoneal seedings treated with radiogold. In 113 patients given 161 radiogold treatments for recurrent malignant effusions, a worthwhile effect was obtained in 62 per cent of the patients. Fifty-six per cent of the 66 patients treated for malignant ascites and 71 per cent of the 47 patients treated for malignant pleural effusion showed a beneficial response. The primary site of origin of the tumor did not appear to influence the results of treatment. These results are in keeping with those previously reported in the literature. The usual dose given was from 150 to 200 millicuries. This appeared to be the optimum dose range. Complications encountered when Au^{198} therapy alone was given were minor except for one patient in whom the radioactive material was inadvertently instilled into the abdominal wall. Extensive external irradiation of the abdomen and/or pelvis after Au^{198} has been given can lead to fibrosis, adhesions and low vitality of bowel, producing the picture of a frozen

abdomen. Subsequent abdominal surgery is hazardous. No appreciable hematopoietic depression was encountered. (auth)

21933

PRELIMINARY FOLLOW-UP STUDY OF PATIENTS EXPOSED TO WHOLE-BODY X-RADIATION. Lowell S. Miller and Gilbert H. Fletcher (Univ. of Texas, Houston). p.472-6 of "Radiation Biology and Cancer."

A group of 199 cancer patients, each of whom received a nominal air dose of 15 to 75 r whole-body x radiation, has been followed for a minimum of three years. Five per cent of the group remains untraced and is presumed dead within the first year. Survival figures at yearly intervals following irradiation have been presented, but there is no evidence to suggest that whole-body irradiation has influenced survival in any way. Available studies of the peripheral blood have disclosed no definite radiation-induced leukopenias or thrombocytopenias. One case of postradiation leukemia is reported. Survival figures are presented for the 64 patients who received nominal air doses of 100 to 200 r whole-body x radiation. Two of the 100 r patients are still living, with demise probably hastened by irradiation in one of the 62 who have died. (auth)

21934

REVIEW OF EXPERIENCE OF 1500 CASES TREATED WITH COBALT-60 GAMMA RAYS AND 22 MEV BETATRON. Gilbert H. Fletcher (Univ of Texas, Houston). p.477-85 of "Radiation Biology and Cancer."

From the analysis of preliminary results concerning carcinomas of the oropharynx, uterine cervix, and urinary bladder tumors, it is evident that supervoltage roentgen therapy is a superior method of treatment in those cancers which are not amenable to conventional methods of treatment with radium and 250 kv radiation. (auth)

21935

APPLICATION OF ATOMIC SCIENCE IN AGRICULTURE AND FOOD. VOLUME II. PRESENT POSITION, FUTURE TRENDS AND TECHNIQUES. Project No. 396. Paris, The Organisation for European Economic Co-Operation, 1959. 249p. $4.00.

A report is given of a European Conference held at O.E.E.C. Headquarters in July 1958, together with the technical papers presented thereat. The purpose of the conference was to review the present stage of development in the application of atomic science in agriculture and food in Europe and the United States, including its economic implications in soil and plant science, animal science, and food preservation. The conference also considered the question of training facilities for research workers and aspects of pollution by waste materials from atomic establishments and made proposals for international co-operation. (auth)

21936

PROTECTIVE TUBUS CAPS FOR THE WORKING HEAD OF A GAMMA DEVICE FOR SHORT-FOCUS THERAPY. M. Sh. Vaynberg. U.S.S.R. Patent 113659. Byull. Izobert., 1958, No. 6.

The caps are placed on the head axis in the front portion of the tubus, and produce, together with the exchangeable diaphragms, a converging gamma beam. In order to prevent irradiation of healthy tissues over a tumor, the caps are made in the form of a cone or a complex body; they are also made in shapes permitting different optimum irradiation conditions for tumors at different depths in the body. (TCO)

CHEMISTRY

General

21937 AECU-4306

Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.

PROGRESS REPORT NO. XXV. July 1959. 88p. Contracts Nonr-1841(10); Nonr-1841(50); AT(30-1)-1937; AF19(604)-5482; and AF33(616)-5920. $13.80 (ph), $4.80(mf) OTS.

Progress is reported on the following: conduction and breakdown, dielectric spectroscopy, chemistry, single crystals, ceramics, magnetics, and magnetic resonance and magneto-optics. (W.L.H.)

21938 AECU-4351

Massachusetts Inst. of Tech., Cambridge.

EQUILIBRIUM EXTRACTION CHARACTERISTICS OF ALKYL AMINES AND NUCLEAR FUELS METALS IN NITRATE SYSTEMS. Quarterly Progress Report IV for the Period April 1–June 30, 1959. Edward A. Mason and Victor C. Vaughen. June 30, 1959. 42p. For [Oak Ridge National Lab]. Contract W-7405-eng-26, Subcontract 1327. $7.80(ph), $3.30(mf) OTS.

Work has progressed on the solvent extraction of zirconium, molybdenum, and samarium and has been initiated on ruthenium. For the first three metals, studies have been made on the following variables; amine concentration in the organic phase, metal concentration in the aqueous phase, nitric acid concentration in the aqueous phase, effect of an added nitrate on the extractions carried out in 2N HNO_3, diluent type (toluene and Amsco Odorless Solvent), and amine type and branching (tertiary-trilauryl amine, secondary–low branching di (tridecyl)amine, secondary – high branching – Amine S-24, and primary – Primene JMT). (auth)

21939 AECU-4359

Anderson Physical Lab., Champaign, Ill.

PROGRESS REPORT FOR JULY 1959. Technical Report No. 8. 7p. Contract AT(11-1)-544. $1.80(ph), $1.80(mf) OTS.

Results of activation and spectrochemical analysis of KCl and KBr are reported. Results of an analysis of the impurity concentration in zone refined KCl are presented. (For preceding period see AECU-4234.) (W.L.H.)

21940 AECU-4360

Anderson Physical Lab., Champaign, Ill.

PROGRESS REPORT FOR THE MONTH OF JULY 1959. Lloyd Hendricks. Aug. 25, 1959. 7p. Contract AT(11-1)-544. $1.80(ph), $1.80(mf) OTS.

Progress is reported on the preparation and analysis of pure alkali halide crystals. A method involving anion exchange resins has been developed for the removal of iron from reagent-grade KCl. Construction has been started on a conductivity-measuring device. (C.W.H.)

21941 ANL-RCV-SL-1545

Argonne National Lab., Lemont, Ill.

LITERATURE SURVEY OF THE PROPERTIES OF FISSION PRODUCT OXIDES, FLUORIDES, AND OXYFLUORIDES. G. Tennenhouse and M. J. Steindler. July 30, 1959. 75p. $12.30(ph), $4.50(mf) OTS.

A literature survey is presented of the reactions and properties of oxides and fluorides of fission products. Only the dry chemistry of the materials is covered.

The thermodynamic properties, heats, and free energies of formation are included. (W.L.H.)

21942 APEX-523
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
ANALYSIS OF YTTRIUM METAL AND YTTRIUM OXIDE. [REPORT] NO. 2. TITANIUM. J. O. Hibbits, W. F. Davis, and M. R. Menke. Oct. 1959. 15p. Contracts AF33(600)-38062 and AT(11-1)-171. $0.50(OTS).

A method for the determination of trace amounts of titanium is presented. The method involves the extraction of the titanium(IV) thiocyanate complex from 6M hydrochloric acid with a solution of 0.01M tri-n-octylphosphine oxide in cyclohexane. Of the 31 metallic elements investigated, only niobium, molybdenum, tungsten, and tantalum interfered seriously. (auth)

21943 BM-RI-5513
Bureau of Mines.
LIQUID-LIQUID EXTRACTION OF CERIUM. D. A. Douglass and D. J. Bauer. 1959. 32p.

The tri-n-butyl phosphate extraction of cerium (IV) from a sulfate leach liquor prepared from a bastnaesite concentrate as well as from pure ceric nitrate solutions is described. The work was done on a laboratory scale using separatory funnels. Extraction from pure cerium solutions entailed no great difficulties; however, extraction from the bastnaesite solution proved more difficult, mainly because of the inhibiting effect of the sulfate ion. Despite this, procedures were developed for obtaining good single-state cerium extraction (95+ %) and a high-purity product (99+ %), although the maximization of both cannot be achieved simultaneously. This necessitates a compromise in any extraction scheme. (auth)

21944 BMI-936
Battelle Memorial Inst., Columbus, Ohio.
THERMODYNAMIC EVALUATION OF MATERIALS IN CONTACT WITH FLUORIDE FUELS. R. C. Crooks, D. E. Sparrow, J. J. Ward, and R. B. Filbert, Jr. Aug. 5, 1954. (Decl. Sept. 9, 1959.) 19p. Contract W-7405-eng-92. $3.30(ph), $2.40(mf) OTS.

The corrosion tendencies of 44 metallic elements, nonmetallic elements, and metal oxides, borides, and carbides were evaluated by means of thermodynamic methods. Standard free energies of reaction and equilibrium constants are compiled for 1200 and 1500°F. The effect of activity coefficients on the thermodynamic corrosion tendency is discussed, together with the effect of complexing actions that alter the effective concentrations of the corrosion reactants and products. Emphasis is placed on the fact that a material that chemically has a strong tendency toward corrosion may be corrosion resistant in practice because of physical factors that protect the material. (auth)

21945 CF-57-4-85
Oak Ridge National Lab., Tenn.
COMPENDIUM OF EXPERIMENTAL RESULTS OF THE CIRCULATION OF AQUEOUS THORIUM OXIDE SLURRIES IN TOROIDS. G. E. Moore, R. F. Benson, F. E. McDaniel, and S. H. Wheeler. April 30, 1957. 68p. $10.80(ph), $3.90(mf) OTS.

Data are presented for all toroid runs which circulated aqueous thorium oxide slurries between August 1954, and October 1956. In addition, a tabulation of the properties of numerous thoria preparations is presented. (auth)

21946 CF-59-10-18
Oak Ridge National Lab., Tenn.
RESULTS OF EXAMINATIONS OF FUSED SALT MIXTURES BY OPTICAL AND X-RAY DIFFRACTION METHODS. R. E. Thoma. Oct. 7, 1959. 72p. $12.30(ph), $4.50(mf) OTS.

A summary of results of examinations of fused salt mixtures is presented. Phase analyses are derived from the two complementing techniques: measurements of optical properties using the polarizing light (petrographic) microscope, and solid phase identification using x-ray-diffraction methods. Investigations of most of the samples on which data are reported were made as a part of a program of phase equilibrium studies of fluoride fused salt mixtures. (auth)

21947 HW-60677
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DECONTAMINATION STUDIES FOR HAPO HIGH TEMPERATURE REACTOR RECIRCULATION SYSTEMS. Progress Report, June 1958—June 1959. L. D. Perrigo and R. D. Weed. June 10, 1959. 34p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

Crud contamination has been successfully removed from stainless steel by a proprietary method, the Turco 4501 Process. This process has exhibited good corrosion characteristics and decontaminating efficiency in all phases from the laboratory studies to in-reactor loop tests. The Turco 4501 Process for carbon steel gives good decontamination factors, but this cleaning is associated with a high corrosion loss. The one step acid persulfate process gave excellent decontamination factors for crud contaminated stainless steel in a laboratory study but these were accompanied with moderately high corrosion losses. Crud contamination on both carbon and stainless steel has been efficiently removed with low corrosion losses by the APACE process. No in-reactor tests have been made to date. The proprietary compound, Turco 4512, has been successfully used to remove induced activities from carbon steel on a laboratory scale. It is ineffective for stainless steel cleaning. Laboratory and exploratory work on reagents for the removal of rupture products is being done by the Chemical Research and Development Operation, HLO. In their studies, the APACE process has shown considerable promise as a rupture product decontaminant. H_2O_2 has also been used as an oxidizing pretreatment with the APACE process with notable results for the dissolution of uranium dioxide. The Turco 4501 Process has been able to remove fission products from carbon steel coupons but with a fairly high corrosion loss. Several different methods have been tried for removing rupture products from out-of-reactor test loops. Only moderate success has been obtained to date. The most promising method will be chosen and used in a few months on the in-reactor 3 by 3 loop in the ETR. (auth)

21948 ISC-1095
Ames Lab., Ames, Iowa.
PULSE COLUMN DESIGN. Lawrence E. Burkhart and R. W. Fahien. Nov. 1958. 118p. Contract W-7405-eng-82. $2.75(OTS).

A stagewise approach was used in a theoretical analysis of pulse columns. In the analysis the column was arbitrarily divided into discrete stages comprising that part of the column between two adjacent perforated plates. The operation of the pulse column was described mathematically using material balance equations, and a design method was derived which used two

stage lines and two operating lines, one set for the pulse generator upstroke and one set for the downstroke. Assuming equilibrium contact, the effect of recycle in a pulse column was shown to cause a large decrease in the separation obtained as the pulse frequency was increased. Hold-up studies were made using isoamyl alcohol–water, and methyl isobutyl ketone–water. The hold-up per cycle of the dispersed phase for both systems was found to be equal to the interstage flow per cycle of the dispersed phase. Hold-up behavior at high frequencies was different for the two systems. Extraction runs were also made using the system methyl isobutyl ketone–acetic acid–water. The effects of recycle were found to result in a drop in column separation efficiency with increased pulse frequency. It was found to be theoretically possible for a column to operate in a pinched-in region even though this is not apparent from an examination of the superficial flow ratio of the two streams being fed to the column. Techniques for sampling interstage flow streams in a column operating in the mixer-settler region are described. (J.R.D.)

21949 KAPL-2000-7

Knolls Atomic Power Lab., Schenectady, N. Y.

REACTOR TECHNOLOGY REPORT NO. 10 — CHEMISTRY. Sept. 1959. 67p. Contract W-31-109-Eng-52. $2.00(OTS).

Analytical Chemistry. A method is presented for the determination of B in B_4C-Zr, clad with Zircaloy. The polarographic determination of Sn in the presence of large amounts of Nb is described. The determination of N_2 in Nb and Nb and U in $Nb-UO_2$ systems is reported. A colorimetric method is presented for the determination of V in Nb–V alloys. Spectroscopy. The use of mass spectrometry in the measurement of burnup of fuels and control materials is reported. The accuracy of the mass spectrometric method for the determination of B isotope abundance was studied. A method for the determination of U on reactor fuel element surfaces by isotopic dilution is reported. The spectrographic analysis of Zr and its alloys and of Co in stainless steel is described. A method is presented for the infrared detection and estimation of traces of oil in water. Radiochemistry. A method is presented for the radiochemical measurement of fissionable material contamination on reactor fuel assemblies. A method is described for the estimation of airborne Ar^{41} and fission product Xe and Kr. Physical Chemistry. The surface area of coarse particles was determined by Kr adsorption. Corrosion and Coolant Chemistry. The mechanisms of reactor system activation were studied. An evaluation was made of radiation hazards resulting from fuel contamination. The decontamination of reactor components exposed to high pressure water coolant was studied. (W.L.H.)

21950 LA-1448

Los Alamos Scientific Lab., N. Mex.

PLASTIC BONDED RDX. E. James, L. C. Smith, W. T. Barry, K. B. Fess, W. A. Lynch, C. L. Miller, J. B. Panowski, M. Schwartz, W. H. Stein, M. J. Urizar, D. W. Niemand, E. E. Shaw, and R. F. Warner. Contract W-7405-eng-36. July 17, 1952. Decl. Sept. 16, 1959. 75p. $12.30(ph), $4.50(mf) OTS.

The preparation and properties of plastic bonded RDX mixtures containing approximately 90 wt. % RDX are described. These mixtures may readily be prepared by a method adaptable to existing ordnance plant equipment. They are roughly comparable to Compositions A and B in sensitivity and explosive performance, but are much stronger physically than these or similar explosives. (auth)

21951 NAA-SR-Memo-2268

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

DENSITY-TEMPERATURE RELATIONSHIPS FOR IRRADIATED DIPHENYL. R. H. J. Gercke. Nov. 13, 1957. 4p. $1.80(ph), $1.80(mf) OTS.

The density of irradiated diphenyl was experimentally determined over the temperature range 300 to 850°F and as a variable of radiation decomposition over the range 0 to 35 wt. % high boiler residue. (auth)

21952 NAA-SR-Memo-2743

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ESTIMATED THERMAL CONDUCTIVITY OF POLYPHENYL REACTOR COOLANTS. G. Asanovich. May 8, 1958. 6p. $1.80(ph), $1.80(mf) OTS.

Twelve methods were investigated for estimating the thermal conductivity of organic liquids. Of the twelve, the Smith correlation was found to be the most useful. The correlation is presented graphically and is believed accurate to ±15% over the temperature range 100 to 700°F for polyphenyls. (auth)

21953 NP-7896

Du Pont de Nemours (E. I.) & Co. Eastern Lab., Gibbstown, N. J.

RESEARCH ON SYNTHESIS OF 1000 DEGREES F. STABLE BASE FLUIDS. Progress Report No. 1 [for] June 1959–August 1959. John A. Parkins. Sept. 16, 1959. 16p. Contract AF33(616)-5843, Supplement 1(59-897). (ELab-B-16).

The continuation of work on antimony-stabilized phosphonitrilic chloride is reported. The oil fractions have been produced in high yield and found to be stable at temperatures of about 435°C. Efforts to elucidate the structure of the composition or the mechanism of inhibition of polymerization were unsuccessful. Preparation of phosphonitrilic chloride in the presence of Fe^{III}, Co^{III}, Cr^{VI}, Zn^{II}, and Bi^{III} did not result in inhibition of polymerization. Efforts were made to replace the chloride of antimony-phosphorus nitrilic chloride with cyanate, thiocyanate, fluoride, trifluoromethyl and phenyl groups. The preparation of antimony nitrilic chloride from ammonium antimony hexachloride (NH_4SbCl_6) is reported. The attempted preparation of phenyl stiboxane from valentinite obtained by precipitation is reported. (auth)

21954 NP-7903

Olin Mathieson Chemical Corp. Specialty Chemicals Research Energy Div., New Haven.

SYNTHESIS OF NITROGEN-CONTAINING HETEROCYCLIC FLUID SYSTEMS. Quarterly Progress Report No. 1 for period: May 15, 1959 to August 14, 1959. E. H. Kober. 26p. Project No. 9(8-7023). Contract AF33(616)-6342.

The present investigation includes in its first stages many preparative problems. Approaches to the synthesis of phenylsubstituted melams have been studied. Nonaphenylmelam, the parent compound of aromatic substituted melams, has been synthesized as a model compound. It was found to exhibit an excellent thermal stability. 2-Diphenylamino-4,6-bis-(pentaphenylmelamino)-s-triazine was synthesized. A number of intermediates for the preparation of substituted melams is described. A simplified procedure for the preparation

of cyameluric chloride was found. Our experiments to investigate the reactivity of this compound resulted in a number of derivatives of cyameluric acid, of substituted melems and of other compounds containing the cyamelurine nucleus. Our studies showed that the reactivity of the chlorine atoms attached to cyameluric chloride is sufficient to warrant other successful substitutions which might lead in the next phases of this investigation to compounds of desired physical properties. (auth)

21955 NP-7930
Rensselaer Polytechnic Inst., Troy, N. Y.
PRECISE MEASUREMENT OF DENSITY AND SURFACE TENSION AT TEMPERATURES UP TO 1000° IN ONE APPARATUS. Technical Report No. 3. Max R. Lorenz and George J. Janz. Aug. 1959. 21p. RPI Project No. 441.35. Contract Nonr-591-(10).

A method for the precise measurement of surface tension and density of molten salts in one apparatus at temperatures up to 1000°C is reported. The essential features of the apparatus are a density bob of special design to enable surface tension data to be gained simultaneously and a continuously variable height crucible arrangement for the liquid sample. A description of the apparatus and the calibration procedures are given in detail. The results for molten potassium nitrate up to 470°C are reported to illustrate the method. (auth)

21956 NP-7932
Eldorado Mining and Refining Ltd., Eldorado, Saskatchewan.
THE ABSORPTIOMETRIC DETERMINATION OF THORIUM IN MISCELLANEOUS PLANT PRODUCTS INCLUDING ORES, CHEMICAL AND GRAVITY CONCENTRATES, URANIUM TRIOXIDE, AND VARIOUS PLANT STREAMS. R. C. Sackville. Apr. 19, 1956. 9p. (AM-117).

This method covers the various initial treatments involved for each type of sample, and the common absorptiometric finish on the correctly adjusted final solutions that result. Ores, gravity concentrates, and mine leach precipitate are fused with sodium peroxide and three individual separations carried out involving caustic-peroxide, ammonium hydroxide, and potassium iodate. Uranium trioxide and diuranate chemical precipitates are simply dissolved in acid and diluted to volume. Aqueous samples such as slurries, raffinates, scrub liquors, and O. K. Liquors can generally be diluted and treated directly providing the rare earths are low relative to the thorium content. Solvent samples are stripped twice with water and diluted as required. Aliquots from these prepared solutions are then taken and the thorium precipitated as the fluoride on a lanthanum carrier. A large dilution factor and the fluoride precipitation serve to reduce or eliminate the majority of interfering cations. Fuming to dryness with perchloric acid removes the remaining anion interferences. The residue is taken up with HCl, hydroxylamine hydrochloride is added, and the orange-red color developed by the addition of thorin reagent. The absorbance of this thorium-thorin complex is measured at 545 mμ on a spectrophotometer. (auth)

21957 OOR-1486.13
Illinois. Univ., Urbana.
ELECTRODE REACTION KINETICS IN FUSED POTASSIUM CHLORIDE–LITHIUM CHLORIDE (thesis). Technical Report No. 6. D. K. Roe. July 15, 1959. 47p. Project No. 1486. Contract DA-11-022-ORD-1987.

The kinetic parameters of four electrode couples in fused KCl–LiCl eutectic at 450°C were experimentally measured using the voltage step method. A theoretical discussion of electrode kinetics is given along with the modifications from which the kinetic parameters are calculated by this method. Differences between the theoretical and experimental current-time curves, during the initial period of kinetic control ($< 2 \times 10^{-5}$ sec), are discussed with respect to the validity of the theoretical assumptions. A method of correcting for such differences was devised. The corrections proved to be significant for the slower electrode reactions which were investigated. Considerable attention was given to preparation and purification of the eutectic melt. The method adopted involved displacement of heavy metal ion impurities by metallic magnesium and filtration of the molten eutectic through sintered quartz. The experimental results show that some charge transfer reactions are very rapid, as might be expected in fused salts, but the rate of the bismuth couple was surprisingly slow. The kinetic parameters of molar exchange current density, transfer coefficient, and heterogeneous rate constant for each electrode couple are, respectively: Cd(II)/Cd(liq), 210 amps. cm.$^{-2}$, 0.13, 0.4 cm. sec.$^{-1}$; Zn(II)/Zn(liq), 150 amps. cm.$^{-2}$, 0.10, 0.4 cm. sec.$^{-1}$; Bi(III)/Bi(liq), 8 amps. cm.$^{-2}$, 0.48, 9×10^{-4} cm. sec.$^{-1}$; and V(III)/V(II), 30 amps. cm.$^{-2}$, 0.67, 0.3 cm. sec.$^{-1}$. The equipment used in the kinetic studies was also used to measure the differential double layer capacity of a platinum surface in contact with the melt. The variation of double layer capacity with potential indicates that chloride ions are specifically adsorbed over a span of about 0.6 volts. (auth)

21958 ORNL-2421
Oak Ridge National Lab., Tenn.
SOLUBILITY RELATIONS AMONG SOME FISSION PRODUCT FLUORIDES IN $NaF-ZrF_4-UF_4$ (50-46-4 MOLE %). W. T. Ward, R. A. Strehlow, W. R. Grimes, and G. M. Watson. Jan. 30, 1958. 34p. Contract W-7405-eng-26. $1.25(OTS).

A study of the solubility relations among some of the fission products in a fuel mixture was carried out. Fluorides such as those of Ce^{141}, La^{140}, Sm^{153}, Y^{91}, and Ba^{133} were used with $NaF-ZrF_4-UF_4$ fuel solution. Experimental procedure is described and data are tabulated. The data reveal that fission product precipitation in $NaF-ZrF_4-UF_4$ is not a reactor problem. Reasonable estimates of the solubility of other rare earths can be made from a consideration of the atomic radii of those investigated. The chemical feasibility of solid-solvent extraction of rare-earth poisons from the molten fluoride fuel was also established. (J.R.D.)

21959 ORNL-2600(Del.)
Oak Ridge National Lab., Tenn.
THERMODYNAMIC ESTIMATE OF THE REACTION OF HYDROGEN WITH OXYGEN-BEARING IMPURITIES IN SALADO SALT AT ELEVATED TEMPERATURES. W. D. Bond and W. E. Clark. Oct. 21, 1959. 25p. Contract W-7405-eng-26. $0.75(OTS).

Thermodynamic estimates indicate that materials produced by a contained nuclear explosion in bedded rock salt which are as efficient reducing agents as hydrogen will be converted to their oxides by oxygen-bearing impurities in the salt. Since all combustible gases are reductants, the results indicate that the production of fuels by a nuclear event in this environment is not likely. The thermodynamic estimates were made

considering reactions between hydrogen and calcium sulfate (anhydrite), iron oxides, carbonaceous materials, and silicates. (auth)

21960 ORNL-2776
Oak Ridge National Lab., Tenn.
PROGRESS REPORT ON THE ANALYSIS OF DISSOLVER SOLUTIONS BY CONTROLLED-POTENTIAL COULOMETRIC TITRATION. W. D. Shults, B. B. Hobbs, E. L. Blevins, and P. F. Thomason. Sept. 29, 1959. 28p. Contract W-7405-eng-26. $1.00(OTS).

The application of controlled-potential coulometry to the determination of U and Pu in various types of dissolver solutions is presented. Two methods were developed for separating U from the sample aliquot prior to its titration: an extraction with triisooctylamine-in-xylene and an extraction with methyl isobutyl ketone. A controlled-potential coulometric titration was developed for Pu analysis. An anion exchange separation procedure for Pu has also been developed. (W.L.H.)

21961 ORNL-2786
Oak Ridge National Lab., Tenn.
THE CONFIGURATIONAL RELATIONSHIP OF 1,2,2-TRIPHENYLETHYLAMINE AND 1,2,2-TRIPHENYLETHANOL. J. B. Christie. Oct. 12, 1959. 79p. Contract W-7405-eng-26. $2.25(OTS).

The purpose of this research is to establish unambiguously the relationship of the configurations of 1,2,2-triphenylethylamine and 1,2,2-triphenylethanol, and to establish the absolute configurations of these same compounds. The value of the specific rotation of completely resolved 1,2,2-triphenylethanol was determined in order to measure the amount of stereospecificity which accompanies the reactions of the compounds in the triphenylethyl system. The deamination of optically pure 1,2,2-triphenylethylamine in glacial acetic acid was studied. A study was made to establish the absolute configurations of 1,2,2-triphenylethylamine and 1,2,2-triphenylethanol through the relationship of these compounds to D-(−)-lactic acid and D-(+)-tartaric acid. The decomposition of N-nitroso-N-acetyl-1,2,2-triphenylethylamine was also studied. (W.L.H.)

21962 PRL-5.26
Pennsylvania State Univ., University Park. Petroleum Refining Lab.
FLUIDS, LUBRICANTS, FUELS AND RELATED MATERIALS. Quarterly Report for January, February, and March 1959. Mar. 31, 1959. 87p. Contract AF33(616)-5460.

A survey of lubricity data experimentally determined by this Laboratory over a period of years is presented to point out a potential explanation of lubrication difficulties experienced with the silicones and silicates in ferrous bearing systems. Data presented indicate that the fluids may preferentially react with the ferrous bearing surface to form a soft but inert compound or alloy involving iron and silicon. This mechanism is similar to the mechanism which has been proposed for the antiwear reaction of materials such as tricresyl phosphate. The data shown have been obtained using a gear pump, a vane pump, and/or the Shell four-ball wear tester. The experimental data shown appear to support and to be consistent with this theory of silicone and silicate lubricity action with bearing surfaces. Recent research and development work at the Wright Air Development Center has suggested the use of 5-ethyl-10,10-diphenylphenazasiline (5,10,10) alone and in combination with other inhibitors as an antioxidant for ester type lubricants. The combination of 5,10,10 and phenyl-alpha-naphthylamine (PAN) in a trimethylol propane ester has shown up well in bench tests, mock-up tests, and in a 400°F test in the J-57 engine. The initiation of a program to determine quantitatively the effect of 5,10,10 alone and in combination with PAN on oxidative stable life, oxidation rate, and oxygen tolerance is presented in this report. Various types of esters are being used in this study. In addition, other additives such as phenothiazine and Primene-81R (a primary aliphatic amine) are being evaluated alone and in combinations. It has not been possible, in many cases, to evaluate completely the oxidative behavior of some materials available for use as high temperature fluid and lubricant components because of the limited sample size. The type test used by this Laboratory has been modified to allow evaluation at 347 or at 500°F using a charge of 25 milliliters instead of the 100 milliliters normally required. Test geometry is kept the same for the two tests. Data comparing the small volume tests with the tests at 347 or at 500°F are presented. A series of 13 experimental neopentyl type esters obtained from the Food Machinery and Chemical Corporation are discussed. Using the small volume oxidation procedure discussed above, it has been possible to evaluate the oxidative behavior of these materials at 347 and at 500°F. Stable life type tests have been conducted at 347°F. At 500°F, oxidation rate and oxygen tolerance are emphasized. Studies to optimize the viscosity-volatility-low temperature fluidity properties of mineral oils and hydrocarbons have been continued. The effect of viscosity level or boiling point on wax yield is evaluated by the deep dewaxing (−65°F) of a series of paraffinic mineral oil fractions. This series of narrow boiling fractions covers a viscosity range of 15 to 83 centistokes at 100°F and normal boiling points over the range of 750 to 920°F. The effect of several dispersant Acryloid polymers on the deep dewaxed oils is shown. In all cases, the amount of thickening caused by the polymer is less, percentage-wise, at −40 than at 210°F. This is in contrast to conventional military hydraulic fluids which have about the same or a higher percentage viscosity due to the polymer at low temperature than at high temperature. Preliminary studies designed to measure more quantitatively the thermal effects on the lubricant are outlined. These studies comprise a more rigorous analysis of the decomposition products, both gaseous and liquid. A series of fluids, lubricants, and base stocks, both mineral oil and synthetic types, have been taken from storage and are being evaluated for changes occurring after long-time storage. These fluids have been stored for periods ranging from 3 to 17 years. Several additional samples have been distributed to organizations for evaluation as a high-temperature hydraulic fluid. (For preceding period see PRL-5.25.) (auth)

21963 RFP-143
Dow Chemical Co. Rocky Flats Plant, Denver.
SODIUM FLUORIDE AS A SPECTROSCOPIC CARRIER FOR PLUTONIUM METAL ANALYSIS. A. J. Johnson and E. Vejvoda. Apr. 20, 1959. Decl. July 30, 1959. 14p. Contract AT(29-1)-1106. $3.30(ph), $2.40(mf) OTS.

A pyroelectric carrier distillation method, using sodium fluoride as a spectroscopic carrier, was developed for the impurity analysis of plutonium metal. (auth)

21964 SCS-M-64

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

THE DETERMINATION OF FREE ACIDITY OF URANIC LIQUORS INCLUDING B CAKE AND M CAKE SOLUTION. Jan. 25, 1955. 5p.

Uranyl and other hydrolyzable ions are complexed with potassium oxalate at approximately 0°C. Free acid is then determined by potentiometric titration, using a standardized sodium hydroxide solution. The method has a concentration range 0.1% w/v nitric acid and more and is generally applicable to solutions containing uranyl salts of strong acids and other cations which are strongly complexed by oxalate ions. Not more than 3 g of uranium should be present in the aliquot of sample used for titration. (auth)

21965 UCRL-8835

California. Univ., Berkeley. Lawrence Radiation Lab.

INTERACTIONS BETWEEN MOLECULES ADSORBED ON A SURFACE. Oktay Sinanoğlu and Kenneth S. Pitzer. Aug. 1959. 44p. Contract W-7405-eng-48. $1.25(OTS).

A derivation of two molecule-surface potential using quantum mechanical third order perturbation theory is presented. It is shown that this potential consists of two parts just as the energy giving the van der Waals attraction of a single molecule to a surface does. The first part exists only when the surface has a net electrostatic field and this is equivalent to the classical polarization effect. The second part arises from the fluctuations of the surface fields and is of the same origin as the dispersion forces. The third order energy, i.e., the new intermolecular interaction caused by the surface, is directly related to the zero-coverage heat of adsorption and except for this experimental quantity, the results do not require specific assumptions about the surface. Thus, the theory is applicable to either metal or insulator surfaces. When both the two molecule-surface and the one molecule-surface interactions are available experimentally (for example, from the application of virial coefficients treatment in physical adsorption) the electrostatic field of the surface can be estimated. (auth)

21966 USNRDL-TR-354

Naval Radiological Defense Lab., San Francisco.

THE COCRYSTALLIZATION OF ALKALINE EARTH ELEMENTS WITH POTASSIUM RHODIZONATE AND AN APPLICATION. H. V. Weiss and M. G. Lai. Aug. 4, 1959. 21p.

A feasibility study of the cocrystallizability of ultramicro-quantities of elements with organic reagents was undertaken. The alkaline earth-potassium rhodizonate system was studied. Results indicated that crystallized rhodizonate was enriched with alkaline earth microcomponent and that the distribution approximated the Doerner-Hoskins type of equilibrium. Quantitative recovery of these elements at concentrations of 10^{-14} to 10^{-16} molar was easily achieved. The usefulness of the cocrystallization process was exemplified by application to the determination of radiobarium in seawater. The cocrystallization step separated barium from sulfate ion which interferes with its determination in radiochemical analysis by the carrier technique. The crystallized material was readily adaptable to incorporation into a conventional radiochemical procedure and gave reliable results. (auth)

21967 WADC-TR-57-113

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

DETERMINATION OF THE SHEAR STABILITY OF VARIOUS AIRCRAFT LUBRICATING GREASES BY THE HIGH TEMPERATURE SHELL ROLL TESTER. [Period covered]: October 1955 to November 1956. Donald T. Kjerland. Apr. 1, 1957. 25p. Project title: AVIATION LUBRICANTS. Task title: AIRCRAFT LUBRICATING GREASES. (AD-118246).

The shear stability of various high temperature lubricating greases was determined at temperatures up to 600°F by use of a Shell Roll Tester which was adapted for high temperature testing. The greases evaluated were of both soap and non-soap types and contained the following types of base fluids: silicone, pentaerythritol ester, diester, substituted m-terphenyl and biphenyl, and petroleum oil. Bargraphs plotting time in the Shell Roll Tester at a given temperature and rotational speed versus the resultant grease consistency were prepared for each of the lubricating greases evaluated. Although the main emphasis in this work was on the determination of the shear stability of a given grease at various temperatures, some testing was done in an effort to determine what effect, if any, rotational speed had on the change in grease consistency in this test. The High Temperature Shell Roll Tester has been shown to be an effective method to determine the shear stability of a lubricating grease at high temperatures. (auth)

21968 WADC-TR-59-129

Wyandotte Chemicals Corp., Wyandotte, Mich.

MECHANISM OF CROSS-LINKING IN THE VULCANIZATION OF NEW ELASTOMERIC POLYMERS. Period covered: April 1, 1958 to April 1, 1959. Kay L. Paciorek, Raymond G. Spain, Eva P. Deck, and Lawrence C. Mitchell. Apr. 30, 1959. 66p. Project title: NEW SYNTHETIC METHODS. Task title: NEW SYNTHETIC METHODS FOR POLYMERS AND FLUIDS. Contract AF33(616)-5642.

In an attempt to elucidate the mechanism of amine-induced cross-linking of the fluoroelastomers vinylidene fluoride-chlorotrifluorethylene (VF-CTFE and vinylidene fluoride-perfluoropropene (VF-PFP)), gelation studies, dehydrohalogenation reactions, pyrolysis, and model compound syntheses were employed. On the basis of these experiments, it was postulated that amine-induced cross-linking of fluoroelastomers occurs via dehydrohalogenation. The literature survey was compiled on the cross-linking of selected elastomers. (auth)

21969 WAPD-CTA(GLA)-162-12

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THE SPECTROGRAPHIC DETERMINATION OF TIN, IRON, CHROMIUM, AND NICKEL IN ZIRCALOY-2 USING HIGH VOLTAGE SPARK POINT-TO-PLANE EXCITATION. R. M. Jacobs and N. E. Gordon. Oct. 24, 1958. 6p. $1.80(ph), $1.80(mf) OTS.

This method covers the spectrochemical determination of tin, iron, chromium, and nickel in Zircaloy-2. The method is applicable to the analysis of any metal specimen which has been removed from ingots, strips, or bars and which has a flat surface area suitable for point-to-plane analysis. The metal sample is prepared for analysis by machining or grinding a smooth flat surface area. The sample is placed on a Petrey stand where excitation is achieved using the appropriate

high-voltage spark parameters. The emitted spectral radiation is dispersed in a large Littrow prism spectrograph and the spectra recorded photographically. Densitometric measurements and calculations are made according to standard spectrochemical practices. (auth)

21970 WAPD-CTA(GLA)-162-14
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROGRAPHIC DETERMINATION OF SODIUM, LITHIUM, BARIUM, AND STRONTIUM IN ZIRCONIUM AND ZIRCALOY USING THE SILVER CHLORIDE CARRIER TECHNIQUE. R. F. Farrell and G. J. Harter. Apr. 10, 1959. 7p. $1.80(ph) $1.80(mf) OTS.

This procedure describes the determination of impurity elements in zirconium and Zircaloy. The elements and concentration ranges in ppm are as follows: sodium, 1 to 100; lithium, 2 to 100; barium, 1 to 100; and strontium, 1 to 100. The method is applicable to the analysis of metal samples which have been removed from ingots, strips, bars, or other shapes and which can be converted readily to the oxide. Synthetic standards containing the appropriate alloying constituents must be used for the analysis of Zircaloys. By varying the exposure and excitation parameters, potassium may be determined by the same general method. (auth)

21971 WAPD-CTA(GLA)-181(Rev. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF CARBON IN ZIRCONIUM AND ZIRCONIUM BASE ALLOYS. K. A. Morrow and E. F. Tretow. Apr. 16, 1959. 5p. $1.80(ph), $1.80 (mf) OTS.

The sample is burned in an oxygen stream using induction heating and the carbon dioxide in the evolved gases is absorbed by a dilute sodium hydroxide solution. The amount of carbon present in the sample is determined by measuring the change in conductance of the absorbing solution and by comparing this change against a standard curve. The method covers the determination of carbon in zirconium and Zircaloy in a concentration range from 10 to 800 ppm on a 0.5-g sample basis. Satisfactory results may be obtained on sample portions as low as 0.1 g, thus extending the upper limit to 4000 ppm carbon. Sample segregation must be taken into consideration whenever smaller samples are used. (auth)

21972 WAPD-CTA(GLA)-371(Rev. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF TIN IN ZIRCONIUM BASE ALLOYS. T. M. Reinhold. Aug. 21, 1959. 4p. $1.80 (ph), $1.80(mf) OTS.

Tin is reduced to the stannous state with aluminum in a hydrochloric–hydrofluoric acid medium. Stannous tin is titrated with standard iodate-iodide solution using the starch iodine system as indicator. This method covers the determination of tin in Zircaloy-2 (1.25 to 1.65%) and Zircaloy-3 (0.20 to 0.30%). (auth)

21973 WAPD-CTA(GLA)-431(Rev. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF URANIUM AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. D. L. Smith, H. R. Wilson, and G. W. Goward. Aug. 17, 1959. 5p. $1.80 (ph), $1.80(mf) OTS.

Samples are dissolved in hydrofluoric and nitric acids. The solutions are saturated with aluminum nitrate, and uranium is extracted with diethyl ether. The uranium is stripped from the ether layer into water, and an aliquot of this solution is fused with a mixture of sodium and lithium fluorides. The fluorescence produced by the uranium is measured with a photoelectric fluorometer. The method covers the determination of uranium in zirconium and Zircaloy in the range of 0.3 to 5 ppm on a one-gram sample basis. These limits can be varied by changing the size aliquot used for the final uranium determination. (auth)

21974 WAPD-CTA(GLA)-626
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PREPARATION OF CuF_2. J. A. Featheringham and C. F. Lentz. Aug. 22, 1958. 2p. $1.80(ph), $1.80(mf) OTS.

A procedure is described for the preparation of copper fluoride to be used as a carrier for spectrochemical analysis. (J.E.D.)

21975 WAPD-CTA(GLA)-631-1
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROGRAPHIC DETERMINATION OF IMPURITIES IN NIOBIUM. J. A. Featheringham, C. F. Lentz, and R. M. Jacobs. Aug. 15, 1958. 8p. $1.80 (ph), $1.80(mf) OTS.

The method covers the spectrographic procedures for the determination of impurities in niobium metal. The twenty-two impurities and concentration ranges are listed. The method is applicable to the analysis of metal samples which can be converted to the oxide by ignition in a muffle furnace. (J.E.D.)

21976 WAPD-CTA(GLA)-631-2
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROGRAPHIC DETERMINATION OF TANTALUM, TITANIUM AND ZIRCONIUM IN NIOBIUM. J. A. Featheringham, C. F. Lentz, and R. M. Jacobs. Aug. 18, 1958. 4p. $1.80(ph), $1.80(mf) OTS.

The method covers the spectrographic procedures for the determination of tantalum, titanium, and zirconium in niobium metal. The method is applicable to the analysis of metal samples which can be converted to the oxide by ignition in a muffle furnace. (J.E.D.)

21977 WAPD-CTA(GLA)-631-3
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROGRAPHIC DETERMINATION OF BORON AND CADMIUM IN NIOBIUM. J. A. Featheringham, C. F. Lentz, and R. M. Jacobs. Aug. 18, 1958. 3p. $1.80(ph), $1.80(mf) OTS.

The method covers the spectrographic procedures for the determination of boron and cadmium in niobium metal. The method is applicable to the analysis of metal samples which can be converted to the oxide by ignition in a muffle furnace. A summary of the procedure is outlined. (J.E.D.)

21978 WAPD-CTA(GLA)-631-5
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE SPECTROGRAPHIC DETERMINATION OF TUNGSTEN IN NIOBIUM. J. A. Featheringham, C. F. Lentz, and R. M. Jacobs. Aug. 19, 1958. 3p. $1.80(ph), $1.80(mf) OTS.

The method covers the spectrographic procedures for the determination of tungsten in niobium metal. The method is applicable to the analysis of metal samples which can be converted to the oxide by ignition in a muffle furnace. (J.E.D.)

21979 WCAP-1165
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
TRANSPORT AND THERMODYNAMIC PROPERTIES OF SATURATED AND COMPRESSED HEAVY WATER. A. A. Bishop. May 1959. 56p.

Thermodynamic and transport properties of heavy water found in the literature were reviewed. Graphs and tables containing values of density, viscosity, enthalpy, entropy, latent heat of vaporization, heat capacity, thermal conductivity, vapor pressure, and the acoustic velocity were compiled from the data found. By assuming that pressure has the same relative effect on a thermodynamic or transport property of heavy water that it has on the corresponding property of light water at a given temperature, the desired physical properties of compressed heavy water were obtained and tabulated. (auth)

21980 AEC-tr-3365
HEAVY WATER PRODUCTION THROUGH THE H_2S/H_2O DUAL TEMPERATURE EXCHANGE PROCESS. (Schwerwasser-Gewinnung Durch das H_2S/H_2O-Zweitemperatur-Austauschverfahren.) G. Weiss. Translated by Julia S. Redford from Chen.-Ing.-Tech. 30, 433-40(1958). 25p. $4.80(ph), $2.70(mf) JCL.

The heavy water dual-temperature production process is described, and the design of a large-scale research plant for production of ½ ton of D_2O per year is presented. (J.R.D.)

21981 AEC-tr-3640
STUDIES ON DESIGN OF APPARATUS FOR CHEMICAL EXPERIMENTS UNDER HIGH PRESSURE (PART I). Yasuzo Kume. Translated for Oak Ridge National Lab. from Rev. Phys. Chem. Japan 17, 1-11(1943). 24p. $4.80(ph), $2.70(mf) JCL.

The problems encountered in the design of a reaction tube and in the design of various connections in the equipment are discussed. (W.L.H.)

21982 AEC-tr-3750
SURFACE CHEMICAL COMPOUNDS AND THEIR ROLE IN ADSORPTION PHENOMENA. Collected Works of the Conference on Adsorption, dedicated to the 200th Anniversary (1755-1955) of Moscow State University named in honor of M. V. Lomonosov. (Poverkhnostnye Khimicheskie Soedineniya i ikh Rol' v Yavleniyakh Adsorptsii. Sbornik Trudov Konferentsii po Adsorbtsii, Posvyashchennoĭ 200-letiyu Moskovskogo Gosudarstvennogo Universiteta imeni M. V. Lomonosova 1755-1955.) A. V. Kiselev. Translated by David Franklin from a publication of the Moscow University Press, 1957. 409p. $4.00(OTS).

Four sessions were held at the conference. The reports of the first session were devoted to investigations of the influence of surface oxides and the structure of activated charcoals and carbon blacks on the adsorption of vapors and the differential heats of adsorption. In the reports of the second session, questions of the chemistry of the surface, and the structure of silica gels, aluminum silicate gels, and porous glasses, and the influence of chemical modification of their surfaces on the adsorption properties are considered. In the reports of the third session, the infrared spectra and dielectric properties of surface chemical compounds and adsorption layers are considered. The last session was devoted to questions of the formation and breakdown of surface forms in catalysis with the objective of elucidating the relation of adsorption to catalysis. (W.L.H.)

21983 AEC-tr-3806
A CONTRIBUTION CONCERNING THE STRUCTURE OF HIGH MELTING POINT HAFNIUM PHASES: HfC–UC Hf_2Si, HfSi AND Hf_5Si_3 (C). H. Nowotny, E. Laube, R. Kieffer, and F. Benesovsky. Translated for Los Alamos Scientific Lab. from Monatsh. Chem. 89, 701-7 (1958). 6p. $1.80(ph), $1.80(mf) JCL.

Properties and structures of high melting hafnium phases are described. UC and HfC dissolve at 2000°C, however a homogeneous solution is not attained. Hf_2Si and HfSi crystallize, as do the corresponding Zr silicides in the $CuAl_2$ or FeB type. Hf_5Si_3 stabilized with carbon or boron has the D_8^8 structure. Other properties and structural information are also included. (J.R.D.)

21984 AEC-tr-3807
ON THE DOUBLE CARBIDES IN THE SYSTEMS: U–Cr–C, U–Mo–C AND U–W–C. H. Nowotny, R. Kieffer, F. Benesovsky, and E. Laube. Translated for Los Alamos Scientific Lab. from Monatsh. Chem. 89, 692-700(1958). 9p. $1.80(ph), $1.80(mf) JCL.

A suggestion for a structure of the isotopes of the double carbides $UCrC_2$, $UMoC_2$, and UWC_2 is derived on the basis of single crystal spectra. Sample preparation method is described and data on various parameters are tabulated. (J.R.D.)

21985 AEC-tr-3810
STUDY OF THE EQUILIBRIA OF AQUEOUS SOLUTIONS CONTAINING COMPLEX CYANIDES OF NICKEL AND COPPER AND FREE POTASSIUM CYANIDE. Libuše Kišová and Věra Čuprová. Translated for Los Alamos Scientific Lab. from Chem. listy 52, 1422-7(1958). 7p. $1.80(ph), $1.80(mf) JCL or LC.

The equilibria in aqueous solutions of a complex nickel-copper-cyanide system was photometrically measured by the method of continual variations. The dissociation constant of the complex $[Ni(CN)_4]^{-4}$ was determined. (auth)

21986 AEC-tr-3820
DEVELOPMENT AND RECENT STATUS OF TECHNOLOGY OF RUBIDIUM AND CESIUM AND THEIR COMPOUNDS. V. E. Pliushchev and I. V. Shako. Translated for Los Alamos Scientific Lab. from Uspekhi Khim. 26, 944-64(1957). 45p. $7.80(ph), $3.30(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 12990.

21987 AEC-tr-3821
THE SEPARATION OF GASES BY ADSORPTION ON CARBON. Kurt Peters and Kurt Weil. Translated by Vija Ábele from Z. Angew. Chem. 43, 608-12(1930). 17p. $4.80(ph), $2.70(mf) JCL.

The experiments of the absorption of Ar, Kr, and Xe have indicated that it is possible to attain a quantitative separation of gases and vapors by absorption on active carbon and a subsequent desorption by determining the successful conditions with a few measurements. (auth)

21988 AEC-tr-3827
POLAROGRAPHIC DEPOLARIZATION EFFECTS OF THORIUM IONS AND SOME OTHER HYDROLYZABLE CATIONS. Jiri Mašek. Translated from Chem. listy 52, 7-15(1958). 14p. $3.30(ph), $2.40(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 7518.

21989 AEC-tr-3848
ELEMENTARY ANALYSIS OF NITROGEN BY THE STRONG PHOSPHORIC ACID–POTASSIUM IODATE METHOD AND THE DUMAS METHOD—SOME INFORMATION OBTAINED BY USE OF THE MASS

SPECTROMETER. Shigeru Ōhashi, Yūji Takayama, Sachiko Taki, and Hiroshi Toya. Translated for Los Alamos Scientific Lab. from Bunseki Kagaku 7, 205-10(1958). 16p. $3.30(ph), $2.40(mf) JCL.

The strong phosphoric acid–potassium iodate method for the determination of nitrogen in chemical compounds is reviewed. This method is unsuitable for the determination of nitrogen in pyridine-type compounds. Mass-spectrometric studies of the decomposition gas indicate the presence of nitrous oxide in addition to the expected nitrogen. (C.W.H.)

21990 AERE-Lib/Trans-761
HIGH FREQUENCY TITRATION. V. A. Zarinskii and I. R. Mandelberg. Translated by P. Collins (U.K.A.E.A. Atomic Energy Research Establishment) from Zavodskaya Lab. 22, 262-70(1956). 17p. (AD-144628).

High-frequency titration of aqueous solutions of electrolytes represents a variation of the conductometric method, which is based on the change of the real conductance of the solutions. For solutions of dielectrics, the measured parameters can be either the dielectric permittivity or the conductance, depending on their nature and the character of the reaction. Basic preference of high-frequency alternating currents for analytical purposes and production control arises from the absence of galvanic contact between the electrodes and the studied system. Thus polarization and catalytic phenomena, which are observed with other methods of electro-analysis, are excluded. One of the problems of investigation by alternating currents of high frequency in chemical analysis is the design of production models of portable, sensitive, and reliable apparatus. (auth)

21991 CEA-tr-A-320
CATHODES D'OXYDES AVEC SUPPORT DE NICKEL. (Oxide Cathodes with Nickel Support.) H. Anders. Translated into French by B. Moreau from Electrotech. u. Maschinenbau 48, 373-8(1957). 4p.

The preparation of a BaO – SrO cathode on a Ni support is described. Ni powder (37 to 44 μ) is compressed in the desired shape and sintered 10 min at 1000°C in H_2. It is then impregnated with BaSr acetate followed by $(NH_4)_2CO_3$ to precipitate the carbonates. A cathode with good mechanical properties and service life results. (T.R.H.)

21992 CEA-tr-A-337
UNE NOUVELLE METHODE DE SEPARATION PAR CHROMATOGRAPHIE SUR PAPIER DU BARYUM, DU STRONTIUM, DU CALCIUM ET DU MAGNESIUM. (New Method for the Paper Chromatographic Separation of Barium, Strontium, Calcium, and Magnesium). F. Modreanu, S. Fisel, and A. Carpov. Translated into French by P. Bory from Naturwissenschaften 44, 615 (1957). 3p.

Paper chromatographic separation of Ba, Ca, Sr, and Mg is described. Propionates of these alkaline earths were separated on Whatman No. 1 paper. (T.R.H.)

21993 CEA-tr-A-603
LES APPLICATIONS DE LA RADIOACTIVITÉ DANS L'ANALYSE CHIMIQUE. (The Applications of Radioactivity in Chemical Analysis.) T. Schoenfeld and E. Broda. Translated into French from Atompraxis 3, 294-9(1957). 12p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 11938.

21994 CEA-tr-A-608
ECHANGE D'IONS PAR FOCALISATION. I. PRINCIPES ET THEORIE. (Ion Exchange by Focusing. I. Principle and Simple Theory). E. Schumacher. Translated into French Helv. Chim. Acta 40, 221-7 (1957). 13p.

In a study of ion exchange apparatus a new technique for resin columns was found. A cation which takes part in the exchange equilibrium is not stopped in a stationary manner when an electric field is applied to the column. The theory and parameters of the technique are discussed, and applications in rapid analyses of cations, separation of trace radioelements, studies of kinetics of complex formation, separation of rare earths, and perhaps, isotope separation are given. (T.R.H.)

21995 CEA-tr-R-493
COPRECIPITATION DU LANTHANE, DU CERIUM ET DE L'AMERICIUM AVEC LE SULFATE DE POTASSIUM. (Coprecipitation of Lanthanum, Cerium, and Americium with Potassium Sulfate). V. I. Grebenshchikova (Grebenstchikova) and V. N. Bobrova. Translated into French by B. de Trezvinsky from Zhur. Neorg. Khim. 3, 40-5(1958). 13p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 13805.

21996 CEA-tr-R-680
PRÉPARATION DE BORE AMORPHE DE GRANDE PURETÉ. II. ANALYSE PHYSICOCHIMIQUE DE LA RÉACTION DU MAGNÉSIUM AVEC L'ANHYDRIDE BORIQUE. (Preparation of High Purity Amorphous Boron. II. Physiochemical Analysis of the Reaction of Magnesium with the Boric Anhydride). V. I. Mikheeva, V. Yu. (Iu.) Markina, and O. N. Kryukova (Krioukova). Translated into French from Zhurg. Neorg. Khim. 2, 1232-41(1957). 22p.

The reaction of B_2O_3 with Mg was studied by varying the composition of the reaction mixture from 0 to 100% and using differential thermal analysis and chemical analysis methods. The reactions taking place were determined, and the reaction mixture which produces the best yield and quality of amorphous B was established by constructing composition-property curves. The utility of such curves in determining the equations for complex reactions is pointed out. (T.R.H.)

21997 CEA-tr-R-720
SYNTHESE DE LA 2-ETHYL-ANTHRONE ET DE LA 2-ETHYL-OXANTHRONE MARQUEES AU CARBONE-14 DANS LE NOYAU ET ÉTUDE DE CERTAINES DE LEURS PROPRIETES. (Synthesis of 2-Ethylanthrone and 2-Ethyloxanthrone Labeled with Carbon-14 in the Nucleus and Study of Some of their Properties.) S. V. Syavtsillo (Siavtsillo), V. I. (S. V.) Savushkina, and E. M. Zhernovskaya (Jernovskaia). Translated into French from Zhur. Obshcheĭ Khim. 28, 1752-4(1958). 9p.

Starting with 2-ethylanthraquinone-C^{14}, anthrone-C^{14} was synthesized and isolated with a 51% yield. The acetate (m.p. 90 to 92°C) was prepared. Starting with 2-ethylanthrone-C^{14}, 2-ethyloxanthrone-C^{14} was prepared with a 59% yield. The hydrogenation and oxidation of these compounds were studied. (T.R.H.)

21998 CEA-tr-X-149
APPLICATION DE LA METHODE D'ECHANGES IONIQUES POUR LE DOSAGE DES IONS SULFURIQUES ET PHOSPHORIQUES. (Application of the Ion Exchange

Method for the Determination of Sulfuric and Phosphoric Ions.) T. Azada. Translated into French by S. S. Minn from Bunseki Kagaku 6, 100-1(1957). 9p.

A progressive ion exchange technique is described for simple, precise determination of sulfate and phosphate ions. As an example, PO_4 is determined by precipitating with uranyl acetate, separation of the UO_2HPO_4 and dissolution in HNO_3, acidic ion exchange, and titration. The acid for dissolution is restored and dissolves the residual precipitate again. A similar procedure can be used for sulfate ions. (T.R.H.)

21999 CEA-tr-X-154

SÉPARATION DU PROTACTIMIUM D'AVEC LE THORIUM À L'AIDE DE RESINES ÉCHANGEUSES DE CATIONS. (Separation of Protactinium from Thorium by Means of Cation Exchange Resins.) K. Kumura, Y. Yokohama, H. Sans, and H. Mabuchi. Translated into French by Sen-Sik Minn from Bunseki Kagaku 6, 637-41 (1957). 13p.

The separation of Pa^{234} from its mother Th^{234} by cation exchange is described. About 0.9 g of Dowex 50-X 12 resin (100-150 mesh) was used in a column 1 $cm^2 \times 1.5$ cm high. The nitric acid solution of Th plus Pa is prepared and passed through the column. The Pa is eluted by 2 N HNO_3 or 0.5% oxalic acid. Distribution coefficients, elution curves, and decay curves are given. (T.R.H.)

22000 GAT-Z-4077

OPTICAL PROPERTIES OF URANIUM HEXAFLUORIDE. I. ABSORPTION SPECTRA IN THE VISIBLE AND NEIGHBORING ULTRAVIOLET REGION. G. D. Sheremet'ev. Translated for Goodyear Atomic Crop. from Optika i Spektroskopiya 1, 181-9(1956). 13p. $3.30(ph), $2.40(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 7638.

22001 NP-tr-276

THE BEHAVIOUR OF SOLID AND MOLTEN COPPER WITH RESPECT TO GASES. A. Sieverts and W. Krumbhaar. Translated by E. L. Poole (U.K.A.E.A. Atomic Energy Research Establishment) from Z. physik. Chem. (Leipzig) 74, 277-307(1910). 41p. $7.80(ph), $3.30(mf) JCL.

Quantitative measurements of the absorption of gases by copper are presented. Oxygen is dissolved by molten copper as cuprous oxide and is not given up on solidification; larger quantities of oxygen lead to formation of cupric oxide. Nitrogen, carbon monoxide, and carbon dioxide are not absorbed by either solid or molten copper. In solid copper, the hydrogen diffusion rate increases with temperature and it is concluded that these elements form true solid solutions. Solid copper does not dissolve sulfur dioxide; however, liquid copper absorbs the gas freely. Data are tabulated. (J.R.D.)

22002 NP-tr-279

THE HYDRODYNAMIC RESISTANCE OF A GRANULAR LAYER SUSPENDED IN A CURRENT. D. M. Mints. Translated by V. Beak (U.K.A.E.A. Atomic Energy Research Establishment) from Doklady Akad. Nauk S.S.S.R. 83, 541-4(1952). 8p. (Figures Omitted). $3.30(ph), $2.40(mf) JCL.

The dependence of the hydrodynamic resistance of a granular layer suspended in a rising current of liquid on its structure was investigated. Parameters of velocity and length were adopted which gave compact and regular distribution of the plotted experimental data. It was found that the granular layer structure was best characterized by the hydraulic radius of the porous medium and the true current velocity. The expression for a general law is given and derivations are presented which may be used in calculating various parameters. (J.R.D.)

22003 Np-tr-281

MAGNETIC SUSCEPTIBILITY OF SOLID SOLUTIONS OF CERTAIN METALLINE COMPOUNDS. (Magnitna Spryynyatlyvist' Tverdykh Rozchyniv Deyakykh Metalopodibnykh Spoluk.) G. V. Samsonov, V. S. Neshpor, and N. S. Strel'nykova. Translated from Dopovidi Akad. Nauk. Ukr. R.S.R., No. 8, 838-9(1958). 7p.

The magnetic susceptibility displayed by the solid solutions of the systems ZrC–NbC, TaC–NbC, TaB_2–ZrB_2, and TiC–TiN was investigated. Data are presented graphically. (J.R.D.)

22004 NP-tr-292

HEAT CONTENT AND LATTICE STRUCTURE OF ACTIVE MAGNESIUM OXIDE. R. Fricke and J. Lüke. Translated by F. Hudswell (U.K.A.E.A. Atomic Energy Research Establishment) from Z. Elektrochem. 41, 174-83(1935). 30p. $4.80(ph), $2.70(mf) JCL.

Magnesium oxide prepared by the dehydration of $Mg(OH)_2$ has greater energy the lower the dehydration temperature and the shorter the time of ignition. Excess contents of total energy up to about 2.7 kcal were found in carefully prepared "active" MgO samples. A marked lattice expansion, found by x-ray methods in agreement with earlier results and in which the expenditure of energy is considerably lowered by the growth of the MgO formed on the brucite, is the main reason for this excess content of energy. Intensity effects of the x-ray interferences indicated random disorder in the energy-rich samples. Differences in crystal size of the MgO are able to yield at most a subordinate contribution to the observed differences in total energy. The importance of these results in the understanding of the $Mg(OH)_2/MgO/H_2O$ equilibrium is discussed along with the appropriate data from the literature. (auth)

22005 NP-tr-294

STRUCTURE AND TRANSFORMATIONS OF THE FLUORIDE COMPOUNDS OF BERYLLIUM. A. V. Novoselova and Yu. P. Simanov. Translated by R. C. Murray (U.K.A.E.A. Atomic Energy Research Establishment) from Uchenye Zapiski, Moskov. Gosudarst. Univ. im. M. V. Lomonosova No. 174, 7-16(1955). 15p. $3.30(ph), $2.40(mf) JCL or LC.

A review of the structure and transformations of fluoberyllates is presented. The structural similarities of fluoberyllates and sulfates are noted as well as those of silica and silicates. Properties and structure of BeF_2 are discussed along with those of fluoberyllate types A_2Bx_4, and $ABeF_3$. (J.R.D.)

22006 NP-tr-295

EQUILIBRIUM IN THE SYSTEM NaF–Na_2BeF_4–H_2O. A. V. Novoselova. Translated by F. Hilton (U.K.A.E.A. Atomic Energy Research Establishment) from Zhur. Obshchei Khim. 4, 1206-10(1934). (Handwritten MS. copy). 10p. $1.80(ph), $1.80(mf) JCL or LC.

Lixiviation of the melt resulting from reaction of sodium silicofluoride with beryl was investigated for the purpose of optimizing extraction conditions for Be in the form of double salt. Data on the solubility of NaF at 0, 20, 40, 60, 80, and 94°C are tabulated along with the solubility of Na_2BeF_4 at the same temperatures and the joint solubility of NaF–Na_2BeF_4. From

these data an equilibrium diagram was prepared. (J.R.D.)

22007 SCL-T-276

MECHANISM OF THE COLD DRAWING OF POLYAMIDES, POLYURETHANS AND POLYESTERS. (Mechanismus der Kaltverstreckung von Polyamiden, Polyurethanen und Polyestern.) H. Wenderoth. Translated by Marcel I. Weinreich (Sandia Corp.) from Kolloid-Z. 124, 116(1951). 3p. $1.80(ph), $1.80(mf) JCL.

A network-type structure is proposed for the polyamides, polyurethans, and for polyethylene. This structure would account for variations in elasticity noted during the cold drawing of these materials. (C.W.H.)

22008

CHANGES IN THE PROPERTIES OF ION-EXCHANGE RESINS PRODUCED BY IRRADIATION WITH IONIZING RADIATION. O. Costăchel, Gh. Furnică, and St. Grigorescu. Acad. rep. populare Romîne, Studii cercetări chim. 6, 67-74(1958). (Translated from Referat. Zhur. Khim. No. 2, 1959, Abstract No. 4080).

Changes in the exchange capacity, activity index, swelling in water, and in the solubility of ion exchange resins (IER) produced by exposure to x rays were investigated. The changes produced when dry and water-swollen IER are irradiated with x rays are quite different. Direct irradiation effects were established as well as an indirect hydroxylation effect which is proportional to the degree of swelling of the IER.

22009

KINETICS OF RADIO-OXIDATION OF CYSTINE IN AQUEOUS SOLUTIONS. Rudolf Brdicka and Zdenek Spurny. Chem. listy 51, 1267-73(1957). (Translated from Referat. Zhur. Khim. No. 13, 1958, Abstract No. 42587.)

Soft x rays (50 kv) accelerate oxidation of cystine (I) in solution, in the presence of O_2 of the air. Decrease of I, which is oxidized probably to disulfoxide, was studied by the authors by the polarographic method in ammoniacal solutions of $CoCl_2$. Kinetics of radio-oxidation was measured in the case of 10^{-3}–10^{-6} M solutions of I at dosage rates of 33 roentgens/second. The graph representing the ratio of reaction yield G at pH 3 to the initial concentration has the configuration of a parabola, i.e., G is approximately proportional to the square root of the concentration of I. At dosages exceeding 18×10^{17} ev/ml, deviations from this correlation occur, which are attributed to regeneration of I from the disulfoxide.

22010

A RAPID ION EXCHANGE METHOD FOR SEPARATING LARGE AMOUNTS OF CERIUM. RARE EARTH ELEMENTS WITH THE APPLICATION OF AMMONIUM NITRILE TRIACETATE AS THE ELUENT. L. Wolf and J. Massonne. Chem. Tech. (Berlin) 10, 290-6 (1958). (Translated from Referat. Zhur. Khim. No. 1, 1959, Abstract No. 892.)

The separation of rare earth elements (REE) of the Ce group is accomplished in columns 130 centimeters long and 4 centimeters wide, filled with the cationite Vofatite, KPS-200, which has a particle size of 0.2 to 0.4 millimeters. The columns are first filled with the mentioned cationite in Zn-form and on the layer thus obtained the very same cationite is placed, which previously has adsorbed the mixture to be separated. The eluant is passed at a rate of 0.5 cm/min first through the cationite in the REE-form and then through the cationite in the Zn-form, and the eluate fractions are collected. The eluant is prepared by dissolving 200 grams of diammonium salt of nitrile acetic acid (I) in three liters of water, and adding ammonia until the required pH (7-8) is reached and by diluting the prepared solution with water to ten liters. I is inferior to ethylenediamine tetraacetic acid in respect to the effectiveness of the separation ability, but it can be used in solutions of a greater concentration. From the eluate containing I and REE the latter are precipitated as oxalates, the precipitates are filtered off, calcined to the oxides and are dissolved in 5% HCl for further spectrophotometric investigation.

22011

MINIMUM CONSUMPTION OF FRESH SOLVENT IN MULTIPLE EXTRACTION. M. Vender (Inst. of Chemical Tech., Prague). Collection Czechoslov. Chem. Communs. 24, 2089-95(1959) July.

A procedure is shown for the calculation of the minimum consumption of fresh solvent in multiple extraction for the case of a ternary system with a region of limited miscibility. The proposed procedure can be used to calculate, with given initial and final concentrations of the raffinate and a given number of extraction stages, the feeds of fresh solvent in the various stages in order that the over-all consumption of solvent be minimal. It can also be used, with a given initial concentration of the raffinate, a given number of extraction stages, and a given over-all consumption of fresh solvent, to determine the partial feeds so as to attain the lowest concentration of the extracted constituent in the raffinate after the extraction. The use of the procedure is illustrated by an example. (auth)

22012

CONTRIBUTION TO THE POLAROGRAPHIC BEHAVIOR OF THREE AND FOUR VALENT CERIUM. J. Doležal and J. Novák (Karlsuniversität, Prague). Collection Czechoslov. Chem. Communs. 24, 2182-90(1959) July. (In German)

The polarographic behavior of three and four valent cerium in alkali carbonate solutions was investigated. From the dependencies it was shown that the probable mechanism of the electrode pattern is expressed by the equation $[Ce(CO_3)_2]^- + 3\ CO_3^{2-} = [Ce(CO_3)_5]^{6-} + e$. The redox system $[Ce(CO_3)_2]^-/[Ce(CO_3)_5]^{6-}$ is reversible and in 2M potassium carbonate this is shown by a well-defined anode-cathode stage with a half-wave potential of −1.158 v. The value for the difference of the logarithms of the complex constants are tabulated. (tr-auth)

22013

RAPID METHODS FOR THE ANALYSIS OF METALS AND MINERAL ORES. VII. POLAROGRAPHIC DETERMINATION OF CERIUM IN ALLOYS AND MINERAL ORES. J. Doležal and J. Novák (Karlsuniversität, Prague). Collection of Czechoslov. Chem. Communs. 24, 2291-8(1959) July. (In German)

With potassium carbonate or potassium sodium tartrate solution as the basic electrolyte, 1% Ce in Fe and Zn, 3% in Al, and 5% in V and Ni can be determined with sufficient accuracy. The results are satisfactory in the presence of Bi, Cr, Ti, Pb, Cd, Mg, Mo, and W. The method can be used to determine 0.1% Ce in Th and U, 0.5% in Y, and 5% in La and Sc. The determination has no interferences in the presence of Pr, Nd, Sa, Gd, and Er. The reproducibility of the results was tested in various materials. (tr-auth)

22014

ANALYTICAL RAPID METHODS FOR THE INVESTIGA-

TION OF METALS AND INORGANIC ORES. X. APPLICATION OF ION EXCHANGERS TO THE DETERMINATION OF MANGANESE AND ALKALINE EARTHS. P. Povondra and Z. Šulcek (Zentralinstitut für Geologie, Prague). Collection Czechoslov. Chem. Communs. 24, 2398-2404(1959) July. (In German)

A method for the separation of manganese and alkaline earths from the usual associated metals by sorption on the strongly acid cation exchanger Amberlit IR-120 was perfected, and the range of existence of the citrate complex of some metal ions was defined. The manganese, alkaline earth, and magnesium ions adsorbed from the column were chromatographically separated by elution with molar solutions of (ethylenediamine)tetraacetic acid by modification of the acidity conditions. (tr-auth)

22015

STUDY OF THE LITHIUM HYDRIDE MOLECULE WITH THE AID OF THE METHOD OF SELF-COHERENT FIELDS WITH THE INTRODUCTION OF A CORE. Sadhan Basu. Compt. rend. 249, 689-90(1959) Aug. 3. (In French)

The self-coherent field method is used for LiH with the implications that the two spin orbitals associated with the 1 s electrons are treated as a core, the molecular orbitals are formed by linear combination of the orthogonal atomic orbitals with the core orbitals, the monocentric integrals are calculated from these orthogonalized orbitals, and the hamiltonian matrix elements of the core are evaluated rigorously. With this hypothesis the ionization energy, total energy, and binding energy can be calculated. Values of 7.30, 217.30, and 1.16 ev were found, respectively, in good agreement with previous results. (J.S.R.)

22016

THE SULFIDES AND OXYSULFIDES OF EUROPIUM. Louis Domange, Jean Flahaut, and Micheline Guittard. Compt. rend. 249, 697-9(1959) Aug. 3. (In French)

The trivalent europium compound Eu_2S_3 could be prepared, but EuS, Eu_3S_4, $Eu_2S_{3.81}$, and Eu_2O_2S were prepared. The crystal structures were determined and the effects of heating in a vacuum and in air were studied. The molecular magnetic susceptibilities were measured at 18°C and are, with respect to the metallic atom, 22.6×10^3 for EuS, 11.5×10^{-3} for Eu_3S_4, and 5.8×10^{-3} for $Eu_2S_{3.81}$. (J.S.R.)

22017

PYROCHLORES OF THE RARE EARTHS AND RUTHENIUM. Félix Bertaut, Francis Forrat, and Marie-Claire Montmory (Laboratoire d'Électrostatique et de Physique du Métal, Grenoble, France). Compt. rend. 249, 829-31(1959) Aug. 10. (In French)

The crystallographic parameters of the pyrochlore-type compounds $T_2Ru_2O_7$, where T is Y, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, or Lu, were determined, and the results are tabulated. From preliminary paramagnetic measurements made on the Gd and Ho Compounds, the Curie constant of Ru^{4+} was determined to be 1.25. (J.S.R.)

22018

EXTRACTION OF FRANCIUM AND RADIUM BY NITROBENZENE. Roland Muxart, Micheline Levi, and Georges Bouissières. Compt. rend. 249, 1000-1(1959) Sept. 14. (In French)

Francium and radium can be extracted from solutions of their tetraphenylborates at pH 9 by nitrobenzene. The presence of EDTA inhibits Ra extraction but not Fr, thus permitting their separation. (tr-auth)

22019

PHOTOMETRIC ESTIMATION OF THORIUM AND URANIUM WITH ARSENAZO III REAGENT. S. B. Savvin (Vernadskii Inst. of Geochemistry and Analytical Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. 127, 1231-4(1959) Aug. (In Russian)

Arsenazo III, which shows clearly contrasting color reactions with Be, Pb, Th, total rare earths, U(IV), and U(VI), was used in photometric determinations of thorium and uranium. (R.V.J.)

22020

DETERMINATION OF IMPURITIES IN SOME CHEMICAL AND METALLURGICAL PRODUCTS FOR NUCLEAR ENERGY UTILIZATION. (BERYLLIUM OXIDE, BERYLLIUM, AND GRAPHITE). J. C. Hutter (Ecole des Mines, Paris). Énergie nucléaire 1, 172-6(1959) July-Aug. (In French)

The spectrographic methods used in industry for the purity control of nuclear beryllium oxide, beryllium, and graphite are described. For some impurities, the admixture of various impurities increases the detection sensitivity. The rare earths should be determined by reactor activation. (tr-auth)

22021

MOBILITY OF DEUTERON IN PALLADIUM UNDER THE ACTION OF AN ELECTRIC FIELD. Vladimir M. Vukanovich. Glasnik Khem. Drushtva, Beogard 22, 81-6(1957). (Translated from Referat. Zhur. Khim. No. 15, 1958, Abstract No. 49486.)

The previously described method (Coehn A., and H. Juergens., Z. phys., 71, 179(1931) was utilized to determine mobility of deuterium and hydrogen in Pd-wire under the action of a constant electric field at current intensity 1.25 to 2.6 amp and a temperature 25-26.5°C. Measurements were carried out after a period from 2 to 10 days following diffusion of deuterium or hydrogen in Pd, by the method of observation of changes in electric conductivity. In contrast with the previously published data (Franzini T., Nuovo cimento, 1936, 13, 74) it was found that mobility of both isotopes of hydrogen differs by not more than 15%.

22022

ON THE REACTION BETWEEN Li_2O, Al_2O_3, SiO_2, AND CaO AT SINTERING TEMPERATURES. COMMUNICATION I. FORMATION OF LITHIUM ALUMINATE IN THE SINTERING OF LITHIUM CARBONATE AND ALUMINUM OXIDE. Ye. I. Maslova and I. S. Lileyev. Izvest. Sibir. Otdel. Akad. Nauk S.S.S.R., No. 1, 63-70 (1958). (Translated from Referat. Zhur. Met. No. 2, 1959, p.75).

The reaction between Li_2CO_2 and Al_2O_3 begins in the 450 to 500°C temperature range. It is established that the most intensive reaction takes place at 1000 to 1100°C. The constants of the rate of the reaction of formation of Li aluminate are the following: $K_{600°} = 0.01667 \cdot 10^{-3}$, $K_{700} = 0.344 \cdot 10^{-3}$, and $K_{750} = 0.777 \cdot 10^{-3}$. The activation energy E = 47,580 cal/mole.

22023

ON THE REACTION BETWEEN LITHIUM, ALUMINUM, SILICON, AND CALCIUM OXIDES AT SINTERING TEMPERATURES. Ye. I. Maslova and I. S. Lileyev. Izvest. Sibir. Otdel. Akad. Nauk S.S.S.R., No. 4, 67-73 (1958). (Translated from Referat. Zhur. Met. No. 2, 1959, p.75).

The reaction between the oxides of Li, Al, Si, and Ca,

and effects of CaO on the formation of $Li_2O \cdot Al_2O_3$ were examined. Study of the reactions by thermal and microscopic analysis shows that Li_2O_3 does not react with CaO up to 1230°C, above which the eutectic melting of the mixture begins. During sintering, Li_2O displaces CaO from $CaO \cdot Al_2O_3$. The reaction begins at 540 to 600°. The decomposition of $CaO \cdot Al_2O_3$ is completed at 1000°. The cake resulting from sintering of the Al_2O_3, CaO, and Li_2O mixtures contains $Li_2O \cdot Al_2O_3$ and CaO. This proves that Li aluminate is the most stable compound, and that CaO does not impede its formation.

22024

THE SPECTROGRAPHIC DETERMINATION OF GERMANIUM IN COAL ASHES. N. V. Arnautov. Izvest. Vostoch. Filialov Akad. Nauk S.S.S.R., No. 1, 49-52 (1957). (Translated from Referat. Zhur. Geol. No. 10, 1957, p.126).

The determination of the Ge content in coal ashes was made by using three standards. The measurement of the ratio of intensity of the line Geλ-3039.06 A to the background was made on a quartz spectrograph, dispersion being produced by a slit-width of 0.02 mm. The sensitivity range of the plates was 0.7 units GOST. The exposure time for the concentration interval of 0.001 ± 0.06% was 20 seconds; for 0.05 ± 0.30% it was 10 seconds. The arc was supplied by alternating current. The best current strength was 5 amp. The method used for the determination was to introduce test powder into the flame of the electric arc in copper electrodes. Cadmium was the internal standard and was introduced in a solution of cadmium iodide in a proportion of metal to make up 2% of the weight of the sample. (TCO)

22025

MEASUREMENT OF THE MOBILITIES OF POSITIVE IONS OF CYCLOPROPANE AND AMMONIA IN ARGON. Daniel Blanc, Jean Cabé, and Gilbert Giron (Centre de Physique Nucléaire, Toulouse). J. phys. radium 20, Suppl. No. 7, 91A-2A(1959) July. (In French)

A self-quenching Geiger-Mueller counter filled with cyclopropane or ammonia molecules mixed with Ar was used to study ionic mobilities. The mobilities were deduced from dead time measurements. The ionic mobility K_1 (in $cm^2/sec/v$) of cyclopropane was found to be 0.85 and for ammonia 0.90. (T.R.H.)

22026

ELECTRICAL AND X-RAY INVESTIGATIONS OF THE SYSTEM $BaTiO_3$–$BaZrO_3$. T. N. Verbitskaya, G. S. Zhdanov, Yu. N. Venevtsev, and S. P. Solov'yev. Kristallografiya 3, 186-96(1958).

Various solid solutions of $BaTiO_3$–$BaZrO_3$ were prepared, having up to 30 mole 1% of the latter, by heating appropriate mixtures of $BaCO_3$, TiO_2, and ZrO_2 at 1400 ± 10°C. The resulting materials were examined by the Debye-Scherrer method with a camera of diameter 11.4 cm and Cr or Cu radiation. With Cr radiation the lines 310 and 222 occur at a sufficiently high angle to give accurate cell dimensions. (For Cu radiation the appropriate lines are 501 and 431.) The significance of the splitting of the lines under the distortions observed is explained. Dimensional measurements were made to ±0.001 A, monoclinic angle to ±1.5', rhombohedral angle to ±1', and axial ratio to ±0.0005. Results are tabulated and discussed. (TCO)

22027

INVESTIGATION OF THE PROCESS OF CRYSTALLISATION OF BARIUM TITANATE FROM A BARIUM CHLORIDE MELT. V. A. Timofeyeva and I. A. Pieteneva. Kristallografiya 3, 214-18(1958).

The process of the crystallization of barium titanate from a barium chloride melt in the temperature interval 1200 to 1470°C was followed by differential thermal analysis. From the data obtained, the phase diagram of the system $BaCl_2$–$BaTiO_3$ was constructed and by choosing the right conditions triangular or square crystals of $BaTiO_3$ could be grown. Properties are listed. (TCO)

22028

THE COLOURS OF TRANSITION METAL HEXAFLUORIDES. W. Moffitt and G. L. Goodman (Harvard Univ., Cambridge, Mass.) and M. Fred and B. Weinstock (Argonne National Lab., Lemont, Ill.). Mol. Phys. 2, No. 2, 109-22(1959) Apr.

The absorption spectra of ReF_6, OsF_6, IrF_6, and PtF_6 have been obtained between 2500 and 40,000 cm^{-1} in the gas phase. The interesting band systems have been assigned on the basis of ligand field theory, and some predictions have been made as to magnetic properties. (auth)

22029

ROTATION ANALYSIS OF THE BAND SYSTEM OF YTTRIUM OXIDE. Ulla Uhler and Lars Åkerlind (Universität, Stockholm). Naturwissenschaften 46, 488 (1959). (In German)

The rotation analysis confirmed that the blue-green system in the yttrium oxide band system represents a $^2\Sigma - {}^2\Sigma(B^2\Sigma - X^2\Sigma)$ transition and the orange system represents a $^2\pi - {}^2\Sigma(A^2\pi - X^2\Sigma)$ transition. The $A^2\pi$ term has a doublet splitting at 430 cm^{-1}, and the $B^2\Sigma$ state shows a large spin splitting. The B_0 and D_0 constants are tabulated. (J.S.R.)

22030

THE EXTRACTION OF CITRATE AND TARTRATE COMPLEXES OF THE TRANSITION METALS. Max Ziegler (Universität, Göttingen, Ger.). Naturwissenschaften 46, 492(1959). (In German)

The citrate and tartrate complexes of the transition metals palladium, vanadium, uranium, iron, bismuth, gold, and cerium can be separated as substituted ammonium salts by liquid-liquid extraction from aqueous solutions with organic solvents. The citrate complex of rhodium and the tartrate complex of zirconium can be extracted in a similar manner. The organic solvent and the solution acidity for the best results are tabulated for each element. (J.S.R.)

22031

ELECTRONOGRAPHIC INVESTIGATION OF THE MOLECULAR STRUCTURE OF LANTHANUM HALIDES. P. A. Akishin and V. A. Naumov. Nauch. Doklady Vysshei Shkoly. Khim. i Khim. Tekhnol., No. 1, 5-7(1959).

Five to seven series of electronograms were plotted from each lanthanum halide compound with and without the use of the s^2 sector at 40, 60, and 80 kv. The evaluation was carried out according to the method of successive approximations and radial distribution. All curves of the radial distribution show two peaks. The first and higher one is interpreted as r(La-X), the second and flat one as r(X-X) (r = interatomic distance, X = F, Cl, Br, I). A flat triangular model of the compounds LaX_3 is formed by the curves of radial distribution. The results are in good agreement with the data on yttrium halogen compounds. The interatomic distances La-X in the series of Cl, Br, and I compounds change accord-

ing to the atomic number of the halogen following a linear law. The distance La-F does not follow this law but shows a considerably reduced value. The results of the approximate computations for lanthanum fluoride, chloride, bromide, and iodide are summarized and their interatomic distances are shown. (TCO)

22032

THE ADSORPTION OF LANTHANUM IONS FROM WEAKLY ALKALINE SOLUTIONS. B. B. Damaskin and N. V. Nikolayeva-Fedorovich. Nauch. Doklady Vysshei Shkoly, Khim. i Khim. Tekhnol., No. 1, 43-7(1959).

The adsorption of lanthanum ions is investigated in alkaline pH ranges where no lanthanum hydroxide precipitation takes place. The differential capacity was measured on an electrode formed by a pendent mercury drop. The change of the hydrogen ion concentration by a KOH addition clearly influences the curves of potential dependence of the differential capacity. In the minimum of the capacity-potential curve, which depends on the diffusibility of the double layer near the zero charge point, the KOH addition causes a capacity increase. The minimum is continuously shifted toward positive potentials. Moreover, the capacity decreases with an increasing pH on strong negative polarization. It is concluded that complex basic ions and not simple La^{3+} ions are adsorbed in weakly alkaline solutions. The KOH addition continuously changes the capacity curve until finally $La(OH)_3$ is precipitated and the curve shows a sudden change. The variation of the capacity curve depending on time has actually been observed. The minimum becomes wider and lower and is shifted toward more negative potentials. In a 0.01 N solution of $LaCl_3$ conspicuously more basic ions are formed than in a 0.001 N solution. (TCO)

22033

SEPARATION OF ISOTOPES BY MEANS OF RECTIFICATION. Ya. D. Zel'venskii, V. Ye. Sokolov, and V. A. Shalygin. Nauch. Doklady Vysshei Shkoly. Khim. i Khim. Tekhnol., No. 2, 388-91(1958).

Results of investigations of methanol rectification in isotope mixtures are presented. The change in the isotope composition was determined according to all methanol-forming elements D, O^{18}, and C^{13}. An amount of radioactive methanol was then added and separation was observed according to the isotope C^{14}. A diagram of the rectification apparatus is included. The isotope concentration of C^{13} and O^{18} was determined by means of mass spectrometry. (TCO)

22034

EMISSION SPECTROMETRIC DETERMINATION OF THE GASEOUS ELEMENTS IN METALS. Velmer A. Fassel, William A. Gordon, Raymond J. Jasinski, and F. Monte Evens (Iowa State Coll., Ames). Rev. universelle mines 15, 4p.(1959).

Development of emission spectrometric analysis of metals such as Zr, Ti, and Th which are affected by trace impurities of gases is described. The gases are removed by a d-c carbon-arc discharge which excites their emission spectra. Quantitative gas evolution is not needed since calibrating standards are used. An excitation chamber of a glass cylinder with stainless steel top and bottom was used and was filled with Ar. Outgassing prior to use minimizes contamination from gases of the excitation chamber walls. (T.R.H.)

22035

ON THE CATALYTIC PROPERTIES OF URANIUM OXIDES. A. Krause and P. Poszwinski. Roczniki Chem. 30, 29-38(1956). (Translated from Referat. Zhur. Khim. No. 23, 1958, Abstract No. 76744.)

The oxides of U were investigated as redox catalysts and their specific and selective action has been confirmed.

22036

CHEMICAL METHODS FOR THE DETERMINATION OF INDIUM, GERMANIUM, BERYLLIUM, NIOBIUM, AND TANTALUM. M. V. Kanyukova. Trudy Vsesoyuz. Magadansk. Nauch.-Issledovatel. Ministerstva Tsvet. Met. S.S.S.R. Div. 4, No. 19, 1-13(1957). (Translated from Referat. Zhur. Met. No. 9, 1958, p.309).

Routine procedures of colorimetric determinations in the form of the oxyquinolinate in CCl_4 are described. The determination of Ge is carried out with phenylfluoron, that of Be is made with quinalizarine; Nb is determined in the form of the Nb^{5+} complex compound with thiocyanic acid; TA is determined with pyrogallol in an acid oxalate solution. Minor changes, introduced into the generally accepted methods, relate to the conditions of the decomposition of the test samples and the separation of elements being determined.

22037

SPECTROSCOPIC METHODS FOR THE DETERMINATION OF NIOBIUM, TANTALUM, ZIRCONIUM, TITANIUM, BERYLLIUM, AND INDIUM. N. A. Nomokonova and I. F. Morozova. Trudy Vsesoyuz. Magadansk. Nauch.-Issledovatel. Inst. Ministerstva Tsvet. Met. S.S.S.R. Div. 4, No. 19, 14-20(1957). (Translated from Referat. Zhur. Met. No. 9, 1958, p.312).

Quantitative spectroscopic methods for the determination of In, Be, and Ti were developed, and the methods for the determination of Nb, Ta, and Zr in ores and the products of their processing were modified. The determinations were carried out according to the method of three standard specimens. Ores with a known content of components were used as standard specimens. Curves were plotted with $\Delta S - \log_{10} C$ coordinates. For the determination of Nb, Ta, Ti, and Zr the test sample was mixed with carbon powder (1 : 1) and introduced into a carbon electrode (E) with a pointed portion 2.6 mm in diameter and 12 mm long, the crater being 1.3 mm in diameter and 5 mm deep. The exposure time was 2-3 min with 15 sec of preliminary sparking with a 9.5-amp current. Mo served as the internal standard. The determination of Be and In was carried out by the introduction of 100 to 200 mg of specimen mixed with the internal standard on paper strips between horizontal carbon E's. The E's were ground into the shape of a cone with a stage area of 3 mm. Cr serves as the internal standard in the determination of Be. For the determination of In, Cd or Bi is used. The ranges of the determinations are (in %): In and Be 0.001 to 1, Ta and Ti 0.05 to 2, Nb 0.03 to 1, Zr 0.12 to 2. The error of the method is (in %): for Nb, In, Ta ± 8, Zr ± 4 to 8, for Be ± 5, and for Ti ± 10.

22038

QUANTITATIVE SPECTROGRAPHIC ANALYSIS OF RARE EARTH ELEMENTS AND THORIUM IN THEIR MIXTURES BY SOLUTION METHOD. Lien-fang Shen, Chien-hwa Chen, Bunlee Huang, and Ting-chao Chang. Wu Li Hsüeh Pao 24, 286-94(1958). (From Sci. Abstr. China; Chem. and Chem. Technol. No. 2, 1958, Abstract No. 124.)

A rather simple spectrochemical method for the determination of are earth elements and thorium mixtures is described. The rare earths and thorium mixture is separated chemically from the minerals. The cerium oxide content is determined volumetrically and then raised to 80.0% by adding pure cerium compound, according to the method proposed by Fassel. A drop of the resulting chloride solution is introduced to the flat top of a graphite electrode, which has been treated previously with a drop of liquid paraffin. The electrode is dried on a hot plate and excited in an activated arc. Spectral line pairs for the determination of La, Nd, Sm, Pr, Y, Gd, Dy, Yb, and Er were selected in the region 3,500 to 4.500 Å, while that of thorium falls in the ultraviolet region. Cerium is used as an internal standard. The root mean square deviations of a single determination vary from 2.9 to 8.8% for different elements. The linearity of the working curves, obtained from a series of widely varying standard samples, and the results of rare earths and thorium for monazite show that method is free from line interference and systematic errors. Comparison was made with regard to the vaporization characteristics of the rare earth oxides and thoria in the carbon d-c arc and their chlorides on the surface of graphite electrode in the a-c arc. The effects of chlorides, nitrates, and sulfates on the line intensity of the rare earths in the latter case were observed. (auth)

22039

THE DETERMINATION OF TANTALUM BY DIFFERENTIAL SPECTROPHOTOMETRY. B. M. Dobkina and T. M. Malyutina. Zavodskaya Lab. 24, 1336-43(1958).

Relative errors can be so diminished by the differential method that this method is as exact as gravimetric analysis. The method is based on using a solution of the element to be determined in increased concentrations as a zero solution. Procedure and apparatus are described. (TCO)

22040

FLUOROMETRIC DETERMINATION OF SULFATE IONS AND SPECTROPHOTOMETRIC DETERMINATION OF THORIUM USING DERIVATIVES OF TRIOXYFLUORON. V. A. Nazarenko and M. B. Shustova. Zavodskaya Lab. 24, 1344-6(1958).

Among the various trioxyfluoron derivatives available for the determinations mentioned, the 9-(o-oxy-phenyl)-trioxyfluoron (Salicylfluoron) appears to be the most suitable. This compound forms a red complex with thorium in weakly acidic medium (pH > 2). The measurements were carried out on mixtures containing 0.4×10^{-5} to 3.6×10^{-5} moles Th, and 3.6×10^{-5} to 0.4×10^{-5} moles salicylfluoron in 20% ethanol. The molar extinction coefficient of the salicylfluoron complex with thorium was found to be 26,000 at pH 4.4, 530 mμ and using $0.3 - 1.0 \times 10^{-5}$ moles Th. Determination of sulfate ion with salicylfluoronate is based on the formation of a sulfate complex which forms with the thorium complex, and according to the fluorescence of the free unreacted salicylfluoron the concentration of SO_4-ion can be determined. (TCO)

22041

THE DETERMINATION OF MAGNESIUM IN ZIRCONIUM USING ION EXCHANGE CHROMATOGRAPHY. S. V. Yelinson and M. S. Limonik. Zavodskaya Lab. 24, 1434-6(1958).

The method is based upon the ability of zirconium to form an easily soluble oxalate complex compound which is not adsorbed by a cation exchanger (cationite). The magnesium in the solution is, however, adsorbed by the cationite and can then be eluted with hydrochloric acid. An ion exchange resin with SO_3H as the active group was used. The columns used were 25 ml burettes with a diameter of 12 mm and a height of 400 mm. Hf, Ti, Ca, Fe, and Al, and other mixtures may be present in the metallic zirconium, since they either form complex compounds which are not adsorbed (as the Zr), or are precipitated out at some point in the analytical procedure. Magnesium in content of 0.005 to 0.1% in zirconium can be determined colorimetrically using titanium yellow. A photocolorimeter of the FEK-M type with green filter (530 mμ) was used in these experiments. The experimental results and the analytical procedure are given. (TCO)

22042

CHEMICAL ANALYSIS METHODS. THE DETERMINATION OF ALUMINUM IN RARE EARTHS. Yu. A. Chernikhov and B. M. Dobkina. Zavodskaya Lab., 25, 131-2(1959).

References on the precipitation of the oxyquinolates of rare earths are contradictory. Since beryllium acts like rare earths (I) with regard to oxines the same principle is applied as in the determination of aluminum in beryllium. The method is based on the extraction of the aluminum oxyquinolate by chloroform from an acetate solution (pH = 5) and a colorimetric determination of the aluminum in the extraction. Hydroxylamine is used as a reducing agent in order to preserve cerium in its trivalent form. The determination of aluminum in neodymium-magnesium melts as well as in chlorides of (I) obtained in the processing of loparite is of practical interest. The disturbing elements, iron, copper, and nickel, are extracted prior to the analysis in the form of diethyl dithiocarbaminates. Thorium can be removed by potassium biphthalate. The aluminum content is determined either visually (colorimetric titration) or spectrophotometrically (at 300-400 mμ) in the usual way. The sensitivity of the method is given as 1×10^{-2}%. (TCO)

22043

COMPLEXOMETRIC DETERMINATION OF ZIRCONIUM IN BORIDES AND NITRIDE. Ye. I. Nikitina. Zavodskaya Lab. 25, 142(1959).

In order to determine larger quantities of zirconium in its borides and nitride (most of which are soluble in sulfuric acid) it is suggested the material be titrated with trilon and complexon surplus be backtitrated with nitric bismuth salts. Thiourea is used as indicator at pH 2. In this way up to 90% zirconium can be determined with an accuracy of ±0.4%. The analysis can be carried out in the presence of sulfuric acid and other acids as well as the majority of bivalent cations. Zirconium forms a number of different complex compounds with trilon. It was also observed that white insoluble compounds form which are dissolved when being heated. The analysis process is described. (TCO)

22044

PRODUCTION OF RADIOACTIVE PREPARATIONS ENRICHED BY THE METHOD OF SZILARD AND CHALMERS. I. PRODUCTION OF RADIOACTIVE PREPARATIONS OF IODINE AND BROMINE. Ignacy Zlotowski, Aleksander Halpern, and Andrzej Polaczek (Jagiellonski Univ., [Poland]). Zeszyty Nauk. Univ. Jagiel. Ser. Nauk Mat. Przyrod. Mat., Fiz. Chem. No. 1, 65-81(1955). (Translated from Referat. Zhur. Khim. No. 13, 1958, Abstract No. 42470.)

The possibility has been ascertained of producing

radioactive preparations of Br and I having an absolute activity of 0.3 to 0.5 μC by means of a small Ra-Be-source in accordance with (n,γ) reaction. The source having an activity of about 2 × 10 neutrons/sec is made of Pt-ampules containing 150 mg Ra in 300 g comminuted Be. Neutrons were decelerated to thermal velocities with a paraffin diaphragm. To obtain I^{128}, CH_3I was activated, to obtain Br^{80}—CH_3Br (I), C_6H_5Br (II) or II with 10% added $C_6H_5NH_2$ (III). The preparations were enriched by the method of Szilard and Chalmers. To separate the unrestrained portion of radioactive isotopes, use was made of extraction with 1.5 N NaOH. Restraining coefficient of I^{128} is 51%, that of Br^{80} obtained by activation of I, II or II + III, 46, 52, and 21%, respectively. Enrichment coefficient of I^{128} is 3×10^4, that of Br^{80} produced from II + III, approximately 10^4.

22045

DETERMINATION OF THE ISOTOPIC COMPOSITION IN CERTAIN NATURAL WATER SOURCES. L. M. Yakimenko, E. D. Kuznets, M. A. Rabinovich, and M. A. Vitashkina. Zhur. Prikladnoĭ Khim. 32, 1244-50(1959) June.

A method and apparatus are suggested for continuous normalization of water samples tested for hydrogen without deuterium. The content of deuterium in specimens from the Moscow water supply (Mytishchenskii source) is 15.8 ± 0.2 γ and in specimens from Caucasian mountain stream is 15.0 ± 0.2 γ. It is shown that the isotopic content of oxygen ($O^{17} - O^{18}$) in tested samples did not exceed 0.2 γ. $\gamma = 10^{-6}$ g/cm³. (R.V.J.)

22046

NITRIC ACID RECOVERY FROM WASTE SOLUTIONS. A. S. Wilson (to U. S. Atomic Energy Commission). U. S. Patent 2,882,129. Apr. 14, 1959.

The recovery of nitric acid from aqueous nitrate solutions containing fission products as impurities is described. It is desirable to subject such solutions to concentration by evaporation since nitric acid is regenerated thereby. A difficulty, however, is that the highly radioactive fission product ruthenium is volatilized together with the nitric acid. It has been found that by adding nitrous acid, ruthenium volatilization is suppressed and reduced to a negligible degree so that the distillate obtained is practically free of ruthenium.

22047

SOLVENT EXTRACTION OF THORIUM VALUES FROM AQUEOUS SOLUTIONS. J. C. Warf (to U. S. Atomic Energy Commission). U. S. Patent 2,883,264. Apr. 21, 1959.

The separation of thorium values from rare earth metals contained in aqueous solutions by means of extraction with a water immiscible alkyl phosphate diluted with a hydrocarbon such as hexane is described. While the extraction according to this invention may be carried out from any aqueous salt solution, it is preferred to use solutions containing free mineral acid. Hydrochloric acid and in particular nitric acid are suitable in a concentration ranging from 0.1 to 7 normal. The higher acid concentration results in higher extraction values.

22048

METHOD OF PREPARING PROTACTINIUM VALUES. Leonard I. Katzin, Raymond G. Larson, Roy C. Thompson, and Quentin Van Winkle (to U. S. Atomic Energy Commission). U. S. Patent 2,887,355. May 19, 1959.

Separation and purification from initial acid leaches of pitchblende of Pa is described. This supernatant acid solution is treated with alkali metal carbonates to precipitate Pa. Silica is removed from the precipitate by hydroxide treatment. The Pa residue is dissolved in HNO_3 and Pa is concentrated by cyclic precipitations with MnO_2. The last solution is hydrolyzed to precipitate Pa. The Pa precipitate contains Ti and Zr which are removed by ion exchange. (T.R.H.)

22049

METHOD FOR PREPARING NORMORPHINE. H. Rapoport and M. Look (to U. S. Atomic Energy Commission). U. S. Patent 2,890,221. June 9, 1959.

An improved method is presented for producing normorphine from morphine. Morphine as the starting material is acetylated by treatment with acetylating agents to produce di-acetyl morphine (heroin). The acetylated compound is reacted with cyanating agents to produce di-acetyl-cyanonormorphine (cyanonorheroin). The di-acetyl-cyanonormorphine compound is then treated in accordance with the improved hydrolysis reactions of the present invention in which concentrated hydrochloric acid is employed for a limited time period to hydrolyze the acetyl group therefrom forming cyanonormorphine. Subsequently, the reaction mixture is diluted and hydrolysis of the cyano groups from the cyanonormorphine is effected with a longer contact time with dilute hydrochloric acid thereby producing normorphine. A high over-all conversion and production of a high purity product which may be radioactively labeled, if desired, is obtained by operation of the process.

22050

ION-EXCHANGE METHOD FOR SEPARATING RADIUM FROM RADIUM–BARIUM MIXTURES. M. E. Fuentevilla (to U. S. Atomic Energy Commission). U. S. Patent 2,892,679. June 30, 1959.

An improved process is presented for separating radium from an aqueous feed solution containing radium and barium values and a complexing agent for these metals. In this process a feed solution containing radium and barium ions and a complexing agent for said ions is cycled through an exchange zone in resins. The radium-enriched resin is then stripped of radium values to form a regeneration liquid, a portion of which is collected as an enriched product, the remaining portion being recycled to the exchange zone to further enrich the ion exchange resin in radium.

22051

RECOVERY OF CESIUM FROM WASTE SOLUTIONS. W. H. Burgus (to U. S. Atomic Energy Commission). U. S. Patent 2,892,680. June 30, 1959.

This patent covers the precipitation of fission products including cesium on nickel or ferric ferrocyanide and subsequent selective dissolution from the carrier with a solution of ammonia or mercuric nitrate.

22052

SEPARATION PROCESS FOR ZIRCONIUM AND COMPOUNDS THEREOF. H. W. Crandall and J. R. Thomas (to U. S. Atomic Energy Commission). U. S. Patent 2,892,681. June 30, 1959.

The separation of zirconium from columbium, rare earths, yttrium and the alkaline earth metals, such mixtures of elements occurring in zirconium ores or neutron irradiated uranium is described. According to the invention a suitable separation of zirconium from a one normal acidic aqueous solution containing salts, nitrates for example, of tetravalent zirconium, pentavalent columbium, yttrium, rare earths in the trivalent

state and alkaline earths can be obtained by contacting the aqueous solution with a fluorinated beta diketone alone or in an organic solvent solution, such as benzene, to form a zirconium chelate compound. When the organic solvent is present the zirconium chelate compound is directly extracted; otherwise it is separated by filtration. The zirconium may be recovered from contacting the organic solvent solution containing the chelated compound by back extraction with either an aqueous hydrofluoric acid or an oxalic acid solution.

Radiation and Radiochemistry

22053 CF-59-8-125
Oak Ridge National Lab., Tenn.
CALIFORNIUM PRODUCTION IN THE HIGH FLUX ISOTOPE REACTOR. H. C. Claiborne and Marjorie P. Lietzke. Aug. 31, 1959. 24p. $4.80(ph), $2.70(mf) OTS.

Californium-252 and other isotope production rates resulting from irradiating Pu-242 in the proposed High Flux Isotope Reactor were estimated. The effect of curium recycle was investigated and optimum irradiation cycles determined. Approximately 60 mg of Cf-252 would be available from the HFIR installation about 1¼ years after exposure of 200 g of Pu-242 is started. The ultimate steady-state production capability is about one gram/yr of Cf-252. (auth)

22054 HW-20803(Del.)
Hanford Works, Richland, Wash.
REMOVAL OF IODINE FROM AQUEOUS SOLUTIONS BY SPARGING. C. H. Holm. June 1951. Decl. with deletions July 7, 1959. 39p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

Nitric acid dissolution of Hanford irradiated uranium releases iodine into solution. Removal of iodine, added as iodine, iodide, or iodate, from simulated dissolver solutions by sparging was studied as a function of temperature, spargant, spargant flow-rate, presence of metallic uranium, nitric acid concentration, and uranyl nitrate concentration. (W.D.M.)

22055 OOR-291.29
Duke Univ., Durham, N. C.
MICROWAVE AND RADIOFREQUENCY SPECTROSCOPY. Includes Papers: 1. ELECTRON RESONANCE MEASUREMENTS ON RADICALS IN GAMMA-IRRADIATED POLYDIMETHYL ITACONATE. 2. ELECTRON RESONANCE SPECTRA OF GAMMA-IRRADIATED POLYMERS: MEASUREMENTS AT 77°K ON POLYMETHACRYLIC ACID AND RELATED COMPOUNDS. Derick W. Ovenall. July 1, 1959. 38p. DA Project No. 599-01-004. Contract DA-36-034-ORD-1233.

This report consists of two papers. The first concerns the interpretation of the hyperfine structure of the electron resonance spectra of radicals produced by the high energy irradiation of simple organic molecules. Dimethyl itaconate was chosen for this study. The second paper describes low-temperature measurements of polymethacrylic acid and related compounds, since it appeared that such studies might yield information on the free radical reactions which occur when solid polymers are irradiated. (auth)

22056 UCRL-8848
California. Univ., Berkeley. Lawrence Radiation Lab.
BIO-ORGANIC CHEMISTRY QUARTERLY REPORT [FOR] MARCH, APRIL, MAY 1959. June 30, 1959. 78p. Contract W-7405-eng-48. $2.25(OTS).

Progress is reported in the following studies: the kinetics of photoconductivity in solid organic dye materials using metal-free phthalocyanine as the test material; the kinetics of the rise and decay of photoinduced unpaired electrons in spinach chloroplasts as measured with a electron-spin-resonance spectrometer; the Hill reaction and $C^{14}O_2$ fixation in intact, washed, and fragmented chloroplasts; carbon-14 tracer studies on the fixation and reduction of carbon dioxide during periods of steady-state photosynthesis; identification of the magnesium ion as the cofactor of carboxydismutose; the biosynthesis of C^{14}-labeled morphine alkaloids; the effects of continuously administered 30% D_2O in drinking water on the incorporation of adenine into nucleic acids in mice; the relationship between brain protein and behavior in rats from various strains; the effect of crystal size on the radiation sensitivity of choline chloride crystals; and an investigation of the chemical properties of n-carboxy-L-glutamic acid anhydride. (For preceding period see UCRL-8698.) (C.H.)

22057
RADIOCHEMICAL METHOD FOR DETERMINATION OF URANIUM IN ROCKS BY MEANS OF FRACTIONAL EXTRACTION WITH ESONE OF Th^{234}. Giulio Alberti, Carlo Bettinali, Franco Salvetti, and Salvatore Santoli (Comitato Nazionale per le Ricerche Nucleari, Milan). Ann. chim. (Rome) 49, 199-204(1959).

Uranium contained in rocks can be determined by separating and counting one of the radioelements in equilibrium with the uranium. Th^{234}, which can be determined by counting the beta radiations of the Pa^{234} in equilibrium with it, was selected. Th^{234} can be easily separated from the other beta emitting elements by extraction with esone. This method is very rapid, and uranium in a concentration of about 0.005% can be determined. (auth)

22058
THE CARRIER-FREE PRODUCTION OF Sb^{125} AND In^{113m}. V. N. Rybakov and I. I. Stronskii. Atomnaya Energ. 6, 208-10(1959) Feb. (In Russian)

An ion exchange method was developed for separating antimony and indium from radioactive tin isotopes. The method permits carrier-free production of Sb^{125} and In^{113m}. (R.V.J.)

22059
STUDY OF THE COMPOUND $UF_6-2TiCl_4$. Michel Michallet, Maurice Chevreton, Pierre Plurien, and Daniel Massignon (Centre de 3e cycle de Chimie générale, Faculté des Sciences, Lyon and Centre d'Études Nucléaires, Saclay, France). Compt. rend. 249, 691-3(1959) Aug. 3. (In French)

The cold reaction of uranium hexafluoride and titanium tetrachloride leads to an intense red solid phase which can be characterized by its x-ray-diffraction pattern. The chemical composition of this phase corresponds to the formula $UF_6(TiCl_4)_2$. (tr-auth)

22060
URANIUM SELENIDE U_2Se_3. Parviz Khodadad. Compt. rend. 249, 694-6(1959) Aug. 3. (In French)

The conditions for the formation of U_2Se_3 are indicated, and the method used for the chemical analysis is discussed. The compound is black with an orthorhombic lattice. The lattice constants are a = 11.33, b = 10.94, and c = 4.06 A. A density of 9.42 was found. The

selenide has a metallic character and a strong reducing power. (J.S.R.)

22061

A NEW METHOD TO OBTAIN URANIUM TETRAFLUORIDE. Jovino D. Pedregal and Francisco Aguilar. Energia nuclear (Madrid) 3, No. 10, 39-49(1959) Apr.-June. (In Spanish)

The production of uranium tetrafluoride by the reaction of a uranium compound with ammonium bifluoride was investigated. Preliminary investigations were made with uranium nitrate and ammonium uranate, and the results showed the possibility of using this method on an industrial scale. The design and construction of reaction vessels for a continuous process production of uranium tetrafluoride and described. The product obtained is of nuclear purity. (J.S.R.)

22062

FLOODING CHARACTERISTICS AND SEPARATION EFFICIENCIES OF PULSED SIEVE-PLATE EXTRACTION COLUMNS. Experimental Data Applied to Design of Extraction Columns. L. D. Smoot, B. W. Mar, and A. L. Babb (Univ. of Washington, Seattle). Ind. Eng. Chem. 51, 1005-10(1959) Sept.

Generalized flooding and mass transfer correlations were developed from experimental data for pulsed sieve-plate extraction columns. The flooding correlation is based on 665 data points and permits the prediction of total flooding velocities with an average deviation of 20% from the experimental values for systems in which water is the continuous phase. The mass transfer correlation is based on 285 data points and permits the prediction of over-all transfer unit heights with an average deviation of 16.4% from the experimental values. This correlation applies to systems in which mass transfer occurs from the dispersed phase to the aqueous continuous phase and where the major resistance to transfer is in the dispersed phase. Nomographs facilitate design calculations. (auth)

22063

LONGITUDINAL MIXING IN A PULSED SIEVE-PLATE EXTRACTION COLUMN. B. W. Mar and A. L. Babb (Univ. of Washington, Seattle). Ind. Eng. Chem. 51, 1011-14(1959) Sept.

The effects of plate geometry, pulsing conditions, liquid properties, and liquid flow rates on longitudinal mixing in a pulsed sieve-plate extraction column 2 inches in diameter were correlated. Experimental data for the hexane-water, benzene-water, and carbon tetrachloride–water systems were obtained using steady-state and delta injection techniques. Empirical correlation of the data permits estimation of continuous phase Peclet numbers with an average deviation of 17% from the experimental values. A nomograph facilititates the calculation. Back-mixing can be decreased by use of higher continuous-phase flow rates, smaller plate spacings, and smaller holes in the plates. (auth)

22064

PERFORATED PLATE COLUMN STUDIES BY THE BOX METHOD OF EXPERIMENTATION. Donald A. Dechman and Matthew Van Winkle (Univ. of Texas, Austin). Ind. Eng. Chem. 51, 1015-18(1959) Sept.

This study verifies the applicability of the Box method of experimentation for correlating efficiency and pressure drop with operating and design variables of a perforated plate column. The independent variables were reflux ratio, vapor mass velocity, weir height, and hole diameter. A second-order polynomial equation with all possible second-order interactions included was selected. The constants were evaluated by a least squares fit of 246 data points and with 28 data points selected by the Box design technique. The lack of fit variance and confidence limits were established for each equation. The Box correlations for efficiency and pressure drop agreed with experimental data in the range of its design. Comparison of the two equations for efficiency showed the Box-designed equation to be satisfactory. (auth)

22065

THE SYNTHESIS OF NON-RANDOM COPOLYMERS BY THE GAMMA IRRADIATION OF EMULSION SYSTEMS. P. Hayden and R. Roberts (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Appl. Radiation and Isotopes 5, 269-79(1959) July.

Gamma irradiation of vinyl monomers emulsified in polymer lattices is shown to be a useful method for the synthesis of non-random copolymers. Examples include the copolymerization of methyl methacrylate and butyl methacrylate with both styrene and vinyl acetate. The reactions are complete after a relatively small dose and no provision need be made to exclude air. The reaction products were separated by fractional precipitation techniques. (auth)

22066

PHOTORADIOCHROMATOGRAPHY—METHOD FOR THE STUDY OF CHROMATOGRAMS WITH RADIOACTIVE SUBSTANCES. A. M. Baptista, A. J. G. Ramalho, and A. M. De Matos Fernandes (Comissão de Estudos de Energia Nuclear, Lisbon). Intern. J. Appl. Radiation and Isotopes 5, 289-92(1959) July.

It is shown that a photographic film is sensitive enough to record the light emitted during the operation of halogen filled Geiger-Müller counters. This fact is applied in studying distributions of radioactivity in chromatograms to obtain the equivalent of autoradiographs with very much improved sensitivity. The method can be made quantitative by the use of a calibration chart relating optical density to number of discharges in the Geiger-Müller counter. (auth)

22067

THE RADIATION-INDUCED CHAIN ALKYLATION OF PROPYLENE WITH ISOBUTANE. P. J. Lucchesi and C. E. Heath (Esso Research and Engineering Co., Linden, N. J.). J. Am. Chem. Soc. 81, 4770-3(1959) Sept. 20.

A study was made of the gas phase alkylation of propylene with isobutane initiated by nuclear radiation at 55 atm pressure and 350 to 400°C. At these conditions, Co-60 radiation initiates a chain reaction and the purely thermal reaction is negligibly slow. Detailed product composition data are given as a function of conversion level. Although the radioalkylation chain reaction gives a complex mixture of products, the major products above butane are dimethylpentanes, isopentane, and olefins. The chain length for this reaction is of the order 20 to 100. It increases with temperature and total pressure, increases directly with increasing olefin concentration and inversely with the half power of radiation dose rate. In addition, the chain radioalkylation has an induction period. It is not possible to decide unequivocally whether this new reaction is an accelerated thermal (i.e., free radical) chain alkylation or a chain reaction propagated by ions peculiar to the radiation method of initiation. However, the data are

discussed from the viewpoint of ordinary free radical chemistry and it is shown that the major results can be reconciled with well established radical reactions. (auth)

22068

THE ROLE OF THE ANALYST IN THE PREPARATION OF HIGH PURITY NUCLEAR MATERIALS. Clement J. Rodden (New Brunswick Lab., AEC, N. J.). J. Chem. Educ. 36, 458-62(1959) Sept.

The role of the analyst in preparing high-purity nuclear materials for the years 1941, 1942, and 1943 is discussed. The present (1958) lower limits of routine spectrographic determination of impurities in uranium metal and compounds are tabulated. (C.J.G.)

22069

ION EXCHANGE STUDIES OF THE ACTINIDE ELEMENTS. Gregory R. Choppin (Florida State Univ., Tallahassee). J. Chem. Educ. 36, 462-5(1959) Sept.

A review is given on ion exchange studies of the actinide elements. References are contained to each of the specific processes. (C.J.G.)

22070

AMORPHOUS AND UNORIENTED CHARACTER OF POLYMERS FORMED IN RADIATION INDUCED SOLID STATE POLYMERIZATION. George Adler (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. 31, 848-9 (1959) Sept.

The degree of crystallinity for polymers derived in the solid state by ionizing radiation is investigated. Experimental irradiations indicate polymerization occurs at definite sites on nuclei in the vicinity of mosaic boundaries, dislocations, and regions of high strain. This results in two phases, one polymer and one monomer. (C.J.G.)

22071

RADIATION INDUCED FREE RADICALS IN LACTOSE. Frank K. Truby and William H. Storey, Jr. (Southwest Research Inst., San Antonio). J. Chem. Phys. 31, 857-8 (1959) Sept.

Heating powdered α lactose to 120°C for several hours in a dry atmosphere revealed only limited reduction of the free radical concentration. The EPR spectrum changes in the hydrated and anhydrous forms are discussed. (C.J.G.)

22072

GAMMA IRRADIATION OF POLY(ALKYL METHACRYLATES). Roger K. Graham (Rohm and Haas Co., Bristol, Penna.). J. Polymer Sci. 38, 209-12(1959) July.

A series of poly(alkyl methacrylates) were prepared from monomer of high purity and subjected to gamma irradiation. Gelation in the n-alkyl series was detected for poly (n-heptyl methacrylate) at 15 Mreps; gel was detected at lower doses as the length of the alkyl group increased. No gelation was found on irradiation of poly (sec-alkyl methacrylates) to relatively high doses; poly(sec-nonyl methacrylate) remained soluble after 40 Mreps of irradiation. Correlation with earlier work on irradiation of poly(alkyl acrylates) is discussed. (auth)

22073

EFFECT OF IONIZING RADIATION ON POLY-(1-PENTENE) AND POLY-(1-HEXENE). Glenn D. Cooper and Alfred R. Gilbert (General Electric Co., Schenectady, N. Y.). J. Polymer Sci. 38, 275-8(1959) July.

Poly-1-pentene and poly-1-hexene were prepared from corresponding olefins using a Ziegler catalyst and extracted with acetone and ethyl acetate. The only unsaturation observed in the infrared spectrum of irradiated polypentene films was trans-vinylene (absorption at 10.35μ). At a dose of 50 Mrep the concentration was 9.8×10^{-5} moles/g, giving a G value of 2.0 for trans-vinylene. Both polymers were cross-linked by electron irradiation and gel was formed at sufficiently high doses. The dose required for incipient gel formation was 7 Mrep for polyhexene and 24 Mrep for polypentene. (C.J.G.)

22074

VULCANISATION BY NUCLEAR RADIATION. Z. N. Tarasova, M. Ya. Kaplunov, B. A. Dogadkin, V. L. Karpov, and A. Kh. Breger. Kauchuk i Rezina No. 5, 14-21(1958).

The structure and properties of radiation vulcanization obtained by irradiating rubbers and their mixtures in a reactor and by gamma radiation from Co^{60} were investigated. The conditions for preparing the homogeneous solid and multi-layer articles by the action of nuclear radiation were also investigated. The compositions tested are described and results are discussed in detail. (TCO)

22075

INVESTIGATION OF RADIOACTIVITY OF COAL ASH BY THE PHOTOEMULSION METHOD. Erno Bujdoso, Laszlo Medveczky, and Sandor Szalay. Magyar Tudományos Akad. Mat. Fiz. Tudományok Osztályának Közleményei 7, No. 2, 129-35(1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 14985.)

The determination of the concentration of uranium in grains of ash obtained when burning coal containing uranium was investigated. The results of the investigations, carried out by the photoemulsion method, have shown that in most cases the uranium fuses with the ash into small spheres of definite diameter and density, and the average contents of pure uranium in these spherical grains of ash reaches approximately 0.65%.

22076

ISOTOPIC EXCHANGE OF SEVERAL ORGANOMERCURY SALTS AND MERCURY HALOID LABELLED BY Hg^{203}. O. A. Reutov, T. A. Smolina, Yang-ch'i Wu, and Yu. N. Bubnov. Nauch. Doklady Vysshei Shkoly. Khim. i Khim., No. 2, 324-7(1958).

The interaction was investigated between mercury halides and α-mercury bromo-cyclohexane, the ethyl- and 1-methyl-ether of the α-mercury bromo-phenyl acetic acid, 3-mercury bromo-camphor, 3-benzyl-3-mercury bromo camphor, 1-mercury chloro-camphenylon, 2-mercury bromo camphane, and n-butyl-mercury bromide. The organomercury salts which are (except 1-mercury chloro-camphenylon) oxo-compounds, react under mild conditions with mercury halides. It appears that the reactivity of the investigated organomercury salts is reduced with respect to mercury halide in a certain order (scheme given). 1-mercury bromo-camphenylon, 2-mercury bromo camphane, and n-butyl-mercury bromide do not enter into the reaction of the isotopic exchange under these conditions. The results of the reactions in benzene and dioxane were compared with those in acetone. It was found that mixtures are contained in acetone which are not removed in the case of a normal dehydration. They are assumed to be responsible for the considerable fluctuations of the rate of reaction observed in acetone. The reaction of

the isotopic exchange is considerably accelerated by acids as well as by bases. It is possible that the bases lead to a solvation of the mercury atom and thus weaken the C–Hg bond. The influence of acids is probably specific only for the cases of the α-mercurized oxo-compounds. Apparently the isotopic exchange in question is a bimolecular reaction of the electrophilic substitution at the saturated carbon atom (S_E 2). (TCO)

22077

THE RADIATION-INDUCED POLYMERIZATION OF ISOBUTENE. W. H. T. Davison, S. H. Pinner, and R. Worrall (Tube Investments Research Labs., Cambridge, Eng.). Proc. Roy. Soc. (London) A252, 187-96 (1959) Sept.

Isobutene polymerizes at low temperatures when exposed to high-energy radiation. The resulting polymer, of high molecular weight, is similar in all respects to normal polyisobutene. The fractional conversion of monomer per unit radiation dose is independent of the intensity of radiation and increases as the temperature is lowered. The polymerization is inhibited by di-isobutene which also inhibits the normal ionic polymerization and by both oxygen and benzoquinone which normally inhibit free radical polymerization but not ionic polymerizations. Carbon tetrachloride has little effect on the rate of the radiation-induced polymerization or on the average degree of polymerization of the product. The reaction is very sensitive to surface and may be in part intrinsically heterogeneous. All the evidence points to a carbonium ion propagation mechanism for the propagation of polymer chains which may be initiated either by primary ion-radicals formed from isobutene or by carbonium ions formed on disruption of the ion-radicals. (auth)

22078

RADICAL AND MOLECULAR YIELDS IN SOLUTIONS OF ACRYLAMIDE IN LIGHT AND HEAVY WATER IRRADIATED WITH ^{60}Co γ-RAYS. D. A. Armstrong, E. Collinson, and F. S. Dainton (The University, Leeds, Eng.). Trans. Faraday Soc. 55, 1375-85(1959) Aug.

Yields of H_2 and H_2O_2, or D_2 and D_2O_2 were measured for Co^{-60} irradiations of solutions of acrylamide in H_2O or D_2O, the acrylamide being sufficient to capture all the available free radicals. At all acrylamide concentrations $G(D_2) < G(H_2)$, $G(D_2O_2) < G(H_2O_2)$ and $G(H_2)$ decreases steadily as the acrylamide-concentration is increased from 1.5×10^{-5} to 4.6×10^{-2} M, in contrast to the earlier reported behavior for $G(H_2O_2)$. It is concluded that acrylamide reacts with the precursors of molecular hydrogen but, in view of the inefficiency of the H + acrylamide reaction compared with H + H_2O_2, it is suggested that these precursors cannot be H atoms exclusively. Measurements on the above concentrations and measurements of G(Fe(II)), made on solutions in H_2O or D_2O containing acrylamide, $Fe(ClO_4)_3$ and $\sim 4 \times 10^{-2}$ $HClO_4$, permitted a calculation of G_H, G_{OH}, G_{-H_2O}, G_D, G_{OD}, and G_{-D_2O} to be made for various acrylamide concentrations within the range 4.3×10^{-3} to 4.3×10^{-1} M. All the radical yields increase with increasing acrylamide concentration, $G_H < G_D$ and $G_{OH} < G_{OD}$; G_{-H_2O} and G_{-D_2O} are independent of acrylamide concentration and differ much less markedly than the radical yields. It is shown that these results cannot wholly be explained on the Magee model for the radiation chemistry of water, and it seems necessary to assume some difference of distribution of H and OH radicals, as on the Lea-Gray model. (auth)

22079

PROCEEDINGS OF THE FIRST ALL-UNION CONFERENCE ON RADIATION CHEMISTRY, MOSCOW, 1957. Parts I through VII. (In English Translation). New York, Consultants Bureau, Inc., 1959. 320p. $125.00.

The first All-Union Conference on Radiation Chemistry was held in Moscow in March, 1957. About 700 persons participated. Fifty-six reports were presented covering primary acts in radiolysis, the effect of radiation on aqueous solutions of inorganic and organic compounds, radiation electrochemical processes, and the effect of radiation on simple organic systems and on polymers. Separate abstracts have been prepared for each paper. (C.H.)

22080

PRIMARY ACTS IN RADIATION CHEMICAL PROCESSES. Part I of Proceedings of the First All-Union Conference on Radiation Chemistry, Moscow, 1957. (In English Translation). New York, Consultants Bureau, Inc., 1959. 31p. $25.00.

Topics discussed include the first stages of radiation chemical reactions in gases, investigation of the ion-molecular elementary act of a radiation chemical process, space-time distribution of radicals and yield of molecular products in water radiolysis in the presence of acceptors, electron paramagnetic resonance of radicals obtained from H_2O and H_2O_2, and the kinetics and mechanisms of nitrogen oxidation under electron impact. (C.H.)

22081

THE FIRST STAGES OF RADIATION CHEMICAL REACTIONS IN GASES. N. N. Tunitskii and S. E. Kuprianov (L. Ia Karpov Inst. of Physical Chemistry). p. 5-9 of "Primary Acts in Radiation Chemical Processes."

Topics discussed include the dissociation of ions in a mass spectrometer, the energy and rate of dissociation of molecular ions, the effect of the ionizing electrons' energy on ionization-dissociation processes, and the relation of dissociation cross sections in ion-molecular collisions to the energy of the ionizing electrons. Data are included on the characteristics of the mass spectra of methane, ethane, and their halogen derivatives. Data are included on radiation chemical reactions in methane. (C.H.)

22082

INVESTIGATION OF THE ION-MOLECULAR ELEMENTARY ACT OF A RADIATION CHEMICAL PROCESS. V. L. Tal'roze and E. L. Frankevich (Inst. of Chemical Physics, Academy of Sciences, U.S.S.R.). p. 11-15 of "Primary Acts in Radiation Chemical Processes."

Results are reported from mass spectrographic investigations of the reactions of ions with molecules during more than 70 reactions. The reproducibility of the data led to the conclusion that ions react with molecules practically without a true activation energy. The existence of hot radicals and hot particles in radiochemical reactions was also investigated. It was concluded that the main part of the reaction energy is liberated in the form of excitation energy of the particles formed, and that the ion-molecular elementary act, as a rule, forms hot ions and radicals. The investigations also showed that in devising a mechanism for a radiation chemical macroreaction it is necessary to take into account ion-molecular reactions and their main characteristics. The role that oxygen atoms may have in radiation chemical reactions in aqueous media is also discussed. (C.H.)

22083

SPACE-TIME DISTRIBUTION OF RADICALS AND THE YIELD OF MOLECULAR PRODUCTS IN WATER RADIOLYSIS IN THE PRESENCE OF ACCEPTORS. V. Yu. (Iu.) Filinovskii and Yu. (Iu.) A. Chizmadzhev. (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). p. 17-20 of "Primary Acts in Radiation Chemical Processes."

Results are reported from an investigation of the existence of free slow electrons resulting from the irradiation of materials. The appearance of such electrons may result in a certain specific chemical effect of primary radiation. An indirect method is described for studying the behavior of free slow electrons in water. (C.H.)

22084

ELECTRON PARAMAGNETIC RESONANCE OF RADICALS OBTAINED FROM H_2O AND H_2O_2. S. D. Kaitmazov, A. M. Prokhorov, and A. B. Tsentsiper (P. N. Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). p. 21-2 of "Primary Acts in Radiation Chemical Processes."

Applications of electron paramagnetic resonance in investigations of free radicals are discussed. A procedure for studying free radicals at low temperatures is described which makes it possible to study radicals that are unstable at normal temperatures. The low-temperature studies make it possible to determine the form of the electron paramagnetic resonance spectrum for the given radicals; to determine the absolute concentration of the radicals; to determine the conditions favorable for preparing radicals of interest; and to determine the presence of radicals in various systems, for example, in reaction mixtures at the moment when chemical reactions occur. Experimental results are given for frozen water, H_2O, H_2O_2, D_2O, OH, OD, H and D atoms, and HO_2. (C.H.)

22085

KINETICS AND MECHANISM OF NITROGEN OXIDATION UNDER ELECTRON IMPACT. M. T. Dmitriev and S. Ia. Pshezhetskii (L. Ia. Karpov Inst. of Physical Chemistry). p. 23-8 of "Primary Acts in Radiation Chemical Processes."

Data are presented on the mechanisms and kinetics of nitrogen oxidation under electron impact. Emphasis is placed on the action of fast electrons at atmospheric pressure. The amount of nitrogen oxides formed was measured in relation to irradiation time, composition of gas mixture, pressure, temperature, thickness of irradiated gas layer, beam strength, and electron energy. Data are tabulated. (C.H.)

22086

RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS (INORGANIC AND ORGANIC SYSTEMS). Part II of Proceedings of the First All-Union Conference on Radiation Chemistry, Moscow, 1959. (In English Translation). New York, Consultants Bureau, Inc., 1959. 80p. $50.00.

Topics discussed include the effect of KBr and KCl concentrations on the yield of molecular products of radiolysis in aqueous solutions; radiation chemical reactions in nitrate solutions; the effect of ionizing radiation on concentrated aqueous solutions of inorganic salts; the formation and reactions of oxygen compounds of iron during radiolysis of aqueous solutions; radiation processes in solutions of tetravalent uranium; the effect of low-energy protons on aqueous solutions; the effect of accelerated electrons on $KMnO_4$ solutions; the effect of gamma radiation on colloidal solutions of cobalt, nickel, silver, and gold sulfides; simultaneous polarographic determination of oxygen and hydrogen peroxide during their formation by radiation; the kinetics of hydrogen peroxide decomposition by gamma radiation; the oxidation of aqueous benzene solutions under the effect of gamma radiation; the effect of x radiation on dilute aqueous solutions of organic materials; conjugated oxidation-reduction processes in the radiolysis of aqueous solutions; and the kinetics of the decoloration of an aqueous methylene blue solution under the effect of x rays. (C.H.)

22087

THE EFFECT OF KBr AND KCl CONCENTRATIONS ON THE YIELD OF MOLECULAR PRODUCTS OF RADIOLYSIS IN AQUEOUS SOLUTIONS. S. A. Brusentseva and P. I. Dolin (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). p. 35-8 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

Results are reported from an investigation of the relation of the yields of molecular radiolysis products to the concentration of the dissolved substance in solutions of KBr and KCl over a wide range of solution concentrations and in the absence of other materials such as oxygen. The solutions were exposed to gamma and x radiations. Data are presented graphically. (C.H.)

22088

RADIATION CHEMICAL REACTIONS IN NITRATE SOLUTIONS. N. A. Bakh, V. I. Medvedoskii, A. A. Revina, and B. D. Bitiukov (Inst. of Physical Chemistry Academy of Sciences, U.S.S.R.). p. 39-43 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

Results are reported from an investigation of the products formed by the radiolysis of nitrate solutions. The hydrogen peroxide and oxygen formed were determined polarographically. A comparison was made of the total amounts of radiation oxidation and reduction products. The investigations showed that in oxygen-free, neutral aqueous nitrate solutions the radiation reactions gave only nitrite, hydrogen, hydrogen peroxide, and oxygen, and that the ratio of the yields of these products depended on the concentration of the solution and dose strength. By choosing suitable concentrations, the evolution of molecular hydrogen was eliminated and under these conditions the formation of nitrate balanced that of hydrogen peroxide and oxygen. (C.H.)

22089

SOME DATA ON THE EFFECT OF IONIZING RADIATION ON CONCENTRATED AQUEOUS SOLUTIONS OF INORGANIC SALTS. A. M. Kabakchi, V. A. Gramolin, and V. M. Erokhin. p.45-8 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

Using concentrated Na, K, NH_4, Sr, Ba, Pb nitrate and Na, K, and Ba chloride solutions as examples, we established that the radiation yields of nitrite ion in the first cast and free chlorine in the second do not depend on the nature of the cation. The yield of radiation chemical reaction products in the above solutions increases noticeably with an increase in solute concentration. This increase is practically independent of the type of radiation. (auth)

22090

FORMATION AND REACTIONS OF OXYGEN COMPOUNDS OF IRON DURING RADIOLYSIS OF AQUEOUS

SOLUTIONS. A. I. Chernova, V. D. Orekhov, and M. A. Proskurnin (L. Ia. Karpov Physicochemical Inst.). p. 49-52 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

Results are reported from a study of the formation and reactions of oxygen compounds of iron during radiolysis of aqueous solutions. The role is examined of radiolytic processes involving the ferrous ions which are oxidized in high yields and involve the organic substance in the solution in a conjugated oxygen reaction. Results are reported from an investigation of the radiation chemical oxidation of Fe^{2+} ions in highly concentrated solutions of Mohr's salt containing an acid concentration up to 5 N. (C.H.)

22091

RADIATION PROCESSES IN SOLUTIONS OF TETRAVALENT URANIUM. V. G. Firsev and B. V. Ershler. p.53-6 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

It was shown that the oxidation of U^{IV} solutions under the action of γ radiation is effected by the OH radical and H_2O_2. The molecular ion H_2^+ does not participate in this process. When the U^{IV} concentration is reduced the oxidation yield decreases as a result of the recombination of H and OH radicals. An equation was deduced giving the relation of $G_{U^{VI}}$ to $[U^{IV}]$ and including the ratio of the rate constants of the three reactions: U^{IV} + OH, H + OH, H + H. A mechanism is proposed for the retardation of U^{IV} oxidation by UO_2^{2+} ions. An hypothesis is put forward on the possibility of the reaction UO_2^{2+} + OH. Kinetic equations based on this mechanism were given which agree with the experimental data. (auth)

22092

THE EFFECT OF LOW ENERGY (LESS THAN 0.7 Mev) PROTONS ON AQUEOUS SOLUTIONS. I. OXIDATION OF FERROUS IONS IN A FRICKE DOSIMETER. Ivan Draganich, Miomir Simich, Nada Milashin, and Branislav Radak (Boris Kidrich Inst. of Nuclear Studies, Belgrade). p.57-61 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

An experimental procedure was developed for irradiating aqueous solutions with low energy protons on a Cockcroft-Walton accelerator with a maximum energy of 1.3 Mev. The proton energy was determined experimentally by two methods: calorimetrically and with the help of an electrostatic deflector. Solutions were irradiated in a Fricke dosimeter using protons over an energy range from 0.65 to 0.15 Mev. The reaction yields obtained for the oxidation of ferrous ions passed through a minimum at a proton energy of 390 kev. A quantitative investigation was made of the relation between reaction yield and proton beam strength over the range $1 \cdot 10^{-9}$ to $5 \cdot 10^{-7}$ a. The yield fell by 50% on increasing the beam strength from $1 \cdot 10^{-8}$ to $3 \cdot 10^{-8}$ a, after which it remained constant. (auth)

22093

THE EFFECT OF LOW ENERGY (LESS THAN 0.7 Mev) PROTONS ON AQUEOUS SOLUTIONS. II. DECOMPOSITION OF OXALIC ACID. Ivan Draganich and Miomir Simich (Boris Kidrich Inst. of Nuclear Studies, Belgrade). p.63-4 of "Radiation Chemistry of Aqueous Solutions (Inorganic Systems)."

In connection with our systematic study of the behavior of aqueous oxalic acid solutions under the action of Co^{60} γ radiation and the radiation of a nuclear reactor, we were also interested in the behavior of this system under the action of low-energy protons. Data are presented on the effect of the number of protons striking the solution, their energy, and the intensity of the proton beam on the radiolysis yield. (auth)

22094

THE EFFECT OF ACCELERATED ELECTRONS ON $KMnO_4$ SOLUTIONS. B. A. Gvozdev and V. N. Shubin (Physical Chemistry Inst., Academy of Sciences, U.S.S.R.). p.65-8 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

An investigation was made of the reduction of aqueous $KMnO_4$ solutions under the action of accelerated electrons in the concentration range 10^{-3}-10^{-1} M. A relation was established between the amount of permanganate reduced and the amount of energy absorbed by the solution, which made it possible to determine the yield of the $Mn^{VII} \rightarrow Mn^{IV}$ reaction. The effect of the acidity of the solution in the pH interval 0.4 to 12 on the reduction rate was elucidated. The presence of a maximum yield at pH ~ 2 was established. It was established that the reaction yield did not depend on the dose strength in the interval from $\sim 10^{16}$ to 10^{19} ev/ml · sec over the electron energy range from 0.1 to 0.7 Mev. (auth)

22095

THE EFFECT OF γ-RADIATION ON COLLOIDAL SOLUTIONS OF COBALT, NICKEL, SILVER, AND GOLD SULFIDES. E. M. Nanobashvili and L. P. Beruchashvili (P. G. Melikishvili Chemistry Inst., Academy of Sciences of the Georgian S.S.R., Tiflis). p.69-72 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

Under the action of γ-radiation, cobalt, nickel, silver, and gold sulfide sols undergo deep changes, resulting in their complete solution or coagulation. The destruction of the stability of these sols during irradiation is explained by secondary radiation chemical reactions between the stabilizing $S^{\prime\prime}$ and $HS^{\prime}$ ions and hydroxyl radicals or hydrogen peroxide molecules, produced in the intermicellar liquid of the irradiated sols. Gels, obtained from CoS and Ag_2S sols by irradiation differed considerably in structure from gels obtained by the action of electrolytes. (auth)

22096

SIMULTANEOUS POLAROGRAPHIC DETERMINATION OF OXYGEN AND HYDROGEN PEROXIDE DURING THEIR FORMATION BY RADIATION. V. I. Medvedovskii (Inst. of Physical Chemistry, Academy of Sceinces, U.S.S.R.). p. 73 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

A method was developed for the simultaneous polarographic determination of hydrogen peroxide and oxygen during their formation under the action of radiation. The principle of the method is based on the use of two mercury dropping electrodes in one cell with one common anode. By means of two independent electrical circuits and a photoregistration device, the two curves of the accumulation of these products with time were plotted simultaneously on one diagram, with constant potentials on the cathodes, corresponding to the limiting currents of H_2O_2 and O_2 reduction. (C.H.)

22097

THE KINETICS OF HYDROGEN PEROXIDE DECOMPOSITION γ-RADIATION. V. (Ia.) Chernykh, S. Ia. Pshezhetskii, and G. S. Tiurikov. (L. Ia. Karpov Physicochemical Inst.). p. 75-9 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 1266.

22098

OXIDATION OF AQUEOUS BENZENE SOLUTIONS UNDER THE EFFECT OF γ-RADIATION. E. V. Barelko, L. I. Kartasheva, P. D. Novikov, and M. A. Proskurnin (L. Ia. Karpov Physicochemical Inst.). p. 81-5 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

Results are reported from an investigation of the oxidation of benzene under the action of large doses of radiation. The theory of the process is discussed. During the irradiation of aqueous solutions of benzene in vacuum both normal phenol and high-molecular phenolic compounds, which precipitated, were formed. The total benzene consumption in this case was approximately 2.0 to 2.5 molecules/100 ev, while the phenol yield was a total of 0.5 molecules/100 ev. A possible scheme is presented for the precipitate. Results are also reported on the formation of phenol in an oxygen atmosphere both in the presence and absence of ferrous ions. (C.H.)

22099

THE EFFECT OF X-RADIATION ON DILUTE AQUEOUS SOLUTIONS OF ORGANIC MATERIALS. V. I. Duzhenkov and P. I. Dolin (Physical Chemistry Inst., Academy of Sciences, U.S.S.R.). p. 87-90 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

The effect of a series of organic substances on the yield of molecular products from water radiolysis was investigated. Results are reported from studies on benzene, heptane, caproic acid, acetic acid, acetone, hexyl alcohol, and ethyl alcohol. Emphasis was placed on the effect of the various additives on hydrogen evolution. From an examination of the data it was concluded that for substances in the same class of organic compound the efficiency of their interaction with OH, HO_2, and H radicals increases as the length of the carbon atom chain increases. Caproic acid reacted with radicals more efficiently than acetic. The same relationship was found between hexyl and ethyl alcohols. With the same chain length, hydrocarbons were found to have the lowest reactivity, acids greater, and alcohols even greater reactivity. (C.H.)

22100

CONJUGATED OXIDATION-REDUCTION PROCESSES IN THE RADIOLYSIS OF AQUEOUS SOLUTIONS. V. D. Orekhov, M. A. Proskurnin, V. A. Sharpatyl (Sharpatyi), and A. A. Zansokhova (L. Ia. Karpov Physicochemical Inst.). p.91-5 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

Results are reported from a series of studies on oxidation-reduction processes in the radiolysis of aqueous solutions. Possible explanations of the production of given molecular products of water radiolysis are discussed. The possibility is considered of excited molecules participating in the observed chemical effects. Reactions with a solution of two substances, acceptors of H and OH radicals and distinguished by high conversion yields, are described as conjugated due to the great similarity to normal chemical conjugated reactions. The study of conjugated radiolysis reactions is considered of interest in the search for methods of directing processes and of sensitizing radiation chemical reactions of non-chain character. Examples of conjugated reactions are tabulated and results are discussed. (C.H.)

22101

THE KINETICS OF THE DECOLORATION OF AN AQUEOUS METHYLENE BLUE SOLUTION UNDER THE EFFECT OF X-RAYS. Ia. L. Shekhtman and T. G. Ratner (Biophysics Inst., Academy of Sciences, U.S.S.R.). p.97-101 of "Radiation Chemistry of Aqueous Solutions (Inorganic and Organic Systems)."

Under the action of ionizing radiation methylene blue is decomposed irreversibly in aqueous solution. The reaction proceeds by an exponential law by which the decomposition rate depends on the initial dye concentration and decreases with an increase in the concentration. The reaction yield depends on pH; there is a maximum at pH = 4. On decreasing the concentration over the range 10^{-3} to 10^{-4} M/liter, the reaction yield decreases by a factor of $1\frac{1}{2}$ to 2. The decoloration of methylene blue may be used as an indicator of the characteristics of the "protective" properties of substances competing in the interaction with active radicals formed in water. The analytical equation of decoloration proposed agrees with experiment. (auth)

22102

RADIATION ELECTROCHEMICAL PROCESSES. Part III of Proceedings of the First All-Union Conference on Radiation Chemistry, Moscow, 1957. (In English Translation). New York, Consultants Bureau, Inc., 1959. 53p. $15.00.

Topics discussed include primary acts in radiation chemical processes; the radiation chemistry of aqueous solutions; radiation electrochemical processes; the effect of radiation on materials involved in biochemical processes; the radiation chemistry of simple organic systems; the effect of radiation on polymers; and radiation sources. (C.H.)

22103

THE MECHANISM OF THE FORMATION OF STATIONARY POTENTIAL DIFFERENCES IN THE Pt/AQUEOUS SOLUTION/Au SYSTEM UNDER THE EFFECT OF γ-RADIATION. Ts. I. Zalkind, V. I. Veselovskii, and G. Z. Gochaliev (L. Ia. Karpov Physicochemical Inst.). p.113-16 of "Radiation Electrochemical Processes."

When an aqueous electrolyte solution is treated with radiation, it may be considered as a solution of mixed water radiolysis products. In solutions not containing oxygen these products are H_2, H, OH, and H_2O_2, which are not in equilibrium. The electrode potential in such a solution will depend on the capacity of the metal for adsorption and ionization of one or another of the radiolysis products. It will be different for different metals. One can choose a pair of electrodes so that one of them will be mainly using the oxidizing radiolysis products, H_2O_2 and OH, and the other the reducing radiolysis products, H_2 and H. This should lead to a certain potential difference being established between the electrodes. Results are reported from studies using platinum and gold electrodes. Data are given on the changes in the potentials of the electrodes during irradiation; the changes in potential of a platinum electrode in irradiated sulfuric acid solution systems; and the potential of a gold electrode in irradiated sulfuric acid solutions. Reaction mechanisms are presented. It is concluded that there is an electrochemical combination of radiolysis products at a certain stationary potential difference between electrodes. Consequently, the system Pt/irradiated solution/Au may be considered as the simplest radiation galvanic cell operated by water radiolysis products. (C.H.)

22104

RADIATION ELECTROCHEMICAL PROCESSES IN AQUEOUS URANIUM SALT SOLUTIONS. N. B. Miller, Ts. I. Zalkind, and V. I. Veselovskii (L. Ia. Karpov Physicochemical Inst.). p.117-22 of "Radiation Electrochemical Processes."

A study was made of the connection between radiation chemical conversions occurring in irradiated solutions and the electrochemical parameters of the system. The electrochemical processes arising during the action of radiation from radon and cobalt-60 on solutions of uranium salts in sulfuric and perchloric acids were investigated. The action of optical radiation on the same system was investigated in parallel. Due to differences in the electrochemical behavior of gold and platinum electrodes it was possible to obtain a stationary potential difference of ~0.8 to 0.85 v by the action of gamma radiation on uranyl salt solution. (C.H.)

22105

RADIATION GALVANIC CELL, BASED ON THE OXIDATION-REDUCED REACTION OF Fe^{2+}/Fe^{3+}. P. I. Dolin and V. I. Duzhenkov (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). p.123-6 of "Radiation Electrochemical Process."

A solution containing 0.9 moles/liter Fe^{2+} and 0.1 moles/liter Fe^{3+} in 3N H_2SO_4 and not containing oxygen was taken for a cell, which converted radiation into elec trical energy. In such a solution the oxidizing products of water radiolysis oxidize divalent iron to trivalent state and the reducing products are isolated in the form of molecular hydrogen. The yield of the radiation chemical oxidation of Fe^{2+} to Fe^{3+} in the given solution was about 8 Fe^{3+} ions per 100 ev. (W.L.H.)

22106

THE BETA CELL. M. F. Lantratov, V. E. Manoilov, and O. A. Miazdrikov. (V. I. Ul'ianov (Lenin) Electrotechnical Inst. of (Leningrad). p. 127-9 of "Radiation Electrochemical Processes."

The principle of converting β-decay energy through a positive half cell by introducing β-activity into the Fe^{2+}/Fe^{3+} oxidation-reduction system was tested experimentally on a series of samples: (+) $Fe^{2+} \xrightarrow{\sim\beta} Fe^{3+} + e$ (–) $\frac{1}{2} H_2 - e \xleftarrow{\sim\beta} H+$. The results are given. (W.L.H.)

22107

THE ELECTROCHEMICAL AND CORROSION BEHAVIOR OF STEEL AND NICKEL ELECTRODES IN SULFURIC ACID SOLUTIONS UNDER THE EFFECT OF γ-RADIATION. Ia. M. Kolotyrkin, N. Ia. Bune, and G. S. Tiurikov. (L. Ia. Karpov Physicochemical Inst.). p. 131-5 of "Radiation Electrochemical Processes."

The electrochemical and corrosion behavior of stainless steel (18-8 type) and Ni in 1.0 N solutions of H_2SO_4 under the action of Co^{60} γ-radiation was investigated. The experiments on corrosion showed that in the absence of radiation, the solution rate of stainless steel was equivalent to the current density. When radiation was applied before the start of the rapid displacement of the potential toward positive values, the solution rate of the steel did not change much. The effect of radiation on a stainless steel electrode is equivalent to its polarization by an anode current. The effect of γ-radiation on a nickel electrode also resulted in displacement of the potential toward positive values. (W.L.H.)

22108

THE EFFECT OF ELECTRON IRRADIATION ON THE CORROSION OF IRON, STAINLESS STEEL AND ALUMINUM IN SODIUM CHLORIDE SOLUTIONS. M. N. Fokin, T. V. Matveeva, N. D. Tomashov, A. V. Bialobzheskii, and V. D. Val'kov. (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). p. 137-43 of "Radiation Electrochemical Processes."

Studies are presented on the effect of electron irradiation on the corrosion properties of Fe, stainless steel, and Al in NaCl solutions. Results show that Al and Fe and stainless steel corrode at a rapid rate when subjected to electron irradiation in the NaCl solutions. (W.L.H.)

22109

THE CHANGES IN THE ELECTROCHEMICAL ACTIVITY OF METALS UNDER THE EFFECT OF RADIATION. I. L. Rozenfel'd and E. K. Oshe. (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). p.145-7 of "Radiation Electrochemical Processes."

Investigations were performed to determine the effect of radiation on the electrical properties of oxide films on metals, which are considered as semiconductors. The investigation procedure consisted of observing the strength of the corrosion current of macrocells in a flowing 3% NaCl solution, which was treated with high-energy electron radiation. Zirconium, iron, and Al were used as electrodes. (W.L.H.)

22110

RADIATION SENSITIZING BY OXIDE SEMICONDUCTORS OF THE FORMATION AND DECOMPOSITION OF HYDROGEN PEROXIDE IN AQUEOUS SOLUTIONS UNDER THE EFFECT OF γ-RADIATION. D. M. Shub, G. S. Tlueikov, and V. I. Veselovskii. (L. Ia. Karpov Physicochemical Inst.). p. 149-54 of "Radiation Electrochemical Processes."

The kinetic relations of the accumulation of H_2O_2 under the action of γ-radiation in an aqueous solution of NaOH in the presence of a semiconductor suspension and in a solution not containing a suspension, are presented. In the presence of a suspension, the accumulation of H_2O_2 was strongly increased in comparison with a solution without a suspension. The high yield of H_2O_2 during the irradiation of semiconductor suspensions is explained by a process of heterogeneous radiation sensitization, similar to that observed in photosensitized systems under the action of optical radiation. (W.L.H.)

22111

THE CHEMICAL EFFECT OF Co^{60} γ-RADIATION ON SOLID CRYSTALLINE SALTS OF IONIC STRUCTURE: KNO_3, $KClO_3$, $KClO_4$. A. S. Baberkin. (L. Ia. Karpov Physicochemical Inst.). p. 155-6 of "Radiation Electrochemical Processes."

This work was performed to elucidate the action of γ-radiation on solid crystalline salts of ionic structure (KNO_3, $KClO_3$, $KClO_4$) at low dose strengths and also the effect of heating temperature of the irradiated salts on the yield of radiolysis products. It was established that solid KNO_3 was decomposed by radiation to form nitrite and gaseous oxygen. The products of the conversion of solid $KClO_3$ are chloride, oxygen, and chlorite. The reduction of solid $KClO_4$ by the action of γ-radiation goes to chlorate. (W.L.H.)

22112

THE EFFECT OF RADIATION ON MATERIALS INVOLVED IN BIOCHEMICAL PROCESSES. Part IV of Proceedings of the First All-Union Conference on Radiation Chemistry, Moscow, 1957. (In English

Translation). New York, Consultants Bureau, Inc., 1959. 38p. $12.00.

Six papers are presented in this portion of the conference on Radiation Chemistry. Separate abstracts have been prepared for each paper. (W.L.H)

22113

THE EFFECT OF X-RADIATION ON PROTEIN SOLUTIONS IN AIR AND VACUUM. T. E. Pavlovskaya (Pavlovskaia) and A. G. Pasynskii (A. N. Bakh Inst. of Biochemistry, Academy of Sciences, U.S.S.R.). p.163-6 of "The Effect of Radiation on Materials Involved in Biochemical Processes."

The radiation conversions of protein molecules from the changes in their absorption spectra were investigated. Absorption curves are given for 0.1% serum albumin solution and 0.1% serum albumin with 3×10^{-7} M catalase before irradiation in air, before irradiation in vacuum, after irradiation in air, and after irradiation in vacuum. (W.L.H.)

22114

THE EFFECT OF Co^{60} γ-RADIATION ON PROTEINS AND AMINO ACIDS. M. A. Khenokh and E. M. Lapinskaya (Lapinskaia) (P. F. Lesgaft State Inst. of Natural Science). p.167-71 of "The Effect of Radiation on Materials Involved in Biochemical Processes."

Results of investigations on the effect of γ rays on protein and amino acid solutions are presented. The action of γ rays on aqueous solutions of albumin, casein, and gelatin produces an increase in the absorption in the region 230 to 300 mμ. Oxidative process, occurring during radiolysis, produce cleavage of amino acids with the liberation of NH_3 and also rupture of carbon chains to form H_2CO. In solutions of aromatic amino acids, γ radiation produces simultaneous reactions of decomposition and hydroxylation of the six-membered ring. (W.L.H.)

22115

THE EFFECT OF Co^{60} γ-RADIATION ON SOLUTIONS OF CARBOHYDRATES. M. A. Khenokh (P. F. Lesgaft State Inst. of Natural Science). p.173-7 of "The Effect of Radiation on Materials Involved in Biochemical Processes."

The effect of gamma radiation on starch, inulin, glucose, fructose, maltose, lactose, sucrose, and raffinose solutions was investigated. The action of γ radiation on solutions of starch, inulin and mon-, di- and trisaccharides produces a compound with λ_{max} at 265 mμ and λ_{min} at 231 mμ. Using quantitative paper chromatography it was shown that the action of γ rays produces hydrolysis of the 1, 4-link in maltose; 1,2-link in sucrose; and the 1,6- and 1,2-links in raffinose. At the same time rupture of the C–C bond occurs in carbohydrates with the elimination of C as H_2CO. Under the effect of γ rays, mannitol is converted into fructose. (W.L.H.)

22116

CHANGES IN THE ABSORPTION SPECTRA OF SOLUTIONS OF NUCLEIC ACIDS AND PYRIMIDINE AND PURINE BASES CAUSED BY γ-RADIATION. T. N. Rysina. p.279-83 of "The Effect of Radiation on Materials Involved in Biochemical Processes."

A study was made of changes in the ultraviolet absorption spectra of dilute solutions of nucleic acids, purines, and pyrimidines, due to the action of γ-radiation in the dose range 1000 to 200,000 roentgens. Irradiation produces a decrease in the ultraviolet absorption of these solutions, which is particularly sharply expressed at the lowest concentrations. The decrease in the optical density of the solution becomes greater as the γ-ray dose increases. It is noticeable that the addition of further chemical groups to the main pyrimidine or purine ring decreases the radiation sensitivity of the molecule. (auth)

22117

THE EFFECT OF IONIZING RADIATION ON ANIMAL FATS. B. N. Tarusov (Moscow State Univ.). p.185-8 of The Effect of Radiation on Materials Involved in Biochemical Processes."

In this investigation the fat extracted from the linear of dogs and bulls was used. Changes in the peroxide and acid numbers of the fats were noted at 5000 r roentgens. The inhibiting effect of cysteinamine on the formation of peroxides in liver fat when added at various stages was studied. Changes in the dielectric permeability of the upper light fractions of a dog liver homogenate were also studied. (W.L.H.)

22118

THE IMPORTANCE OF THE IONIZATION OF IRON-CONTAINING COMPOUNDS DURING X-IRRADIATION OF AN ORGANISM. S. E. Manoilov (Central X-Radiological Research Inst., Leningrad). p.189-91 of "The Effect of Radiation on Materials Involved in Biochemical Processes."

Studies are presented of the cytochrome system in an irradiated organism. To determine the degree of sensitivity of tissues to a shortage of oxygen, experiments were performed with the isolated heart of the grass frog. The experiments showed that with a radiation dose of 12,000 to 15,000 roentgens, the sensitivity of an isolated heart to oxygen shortage was noticeably increased. (W.L.H.)

22119

RADIATION CHEMISTRY OF SIMPLE ORGANIC SYSTEMS. Part V of Proceedings of the First All-Union Conference on Radiation Chemistry, Moscow, 1957. (In English Translation). New York, Consultants Bureau, Inc., 1959. 52p. $30.00.

Nine papers are presented in their section of the Radiation Chemistry Conference. Separate abstracts have been prepared for each paper. (W.L.H.)

22120

THE REACTIONS OF GASEOUS SATURATED HYDROCARBONS AND ETHYLENE UNDER THE EFFECT OF FAST ELECTRONS. B. M. Mikhailov, L. V. Tarasova, V. G. Kiselev, and V. S. Bogdanov (Inst. of Organic Chemistry of the Academy of Sciences, U.S.S.R.). p.199-202 of "Radiation Chemistry of Simple Organic Systems."

The results obtained during the investigation of the effect of fast electrons on gaseous methane, ethane, propane, n-butane, and ethylene are presented. A study was made of the dependence of radiolysis on the original gas pressure, current strength, and irradiation time. The data show that the stabilities of methane and ethane to radiation are ~ the same, but those of propane and n-butane are lower. The main process in radiolysis of saturated gaseous hydrocarbons is dehydrocondensation with the formation of saturated hydrocarbons. In investigating the radiolysis of ethylene the effect of irradiation time, initial pressure, and dilution of the original ethylene with nitrogen and hydrogen was studied. Data show that the main gaseous products of ethylene radiolysis are butane and acetylene. (W.L.H.)

22121
SOME PROBLEMS IN THE RADIATION CHEMISTRY OF MIXTURES OF ORGANIC SUBSTANCES. Kh. S. Bagdasar'ian, T. S. Nikitina, and V. A. Krongauz (L. Ia. Karpov Physicochemical Inst.). p.203-7 of "The Radiation Chemistry of Simple Organic Systems."

The deviation from radiation chemical additivity was investigated either by direct determination of the yield of primary radicals or by determination of the rate of decomposition of the substance in dilute solution under conditions allowing accurate control of secondary reactions. (W.L.H.)

22122
THE EFFECT OF γ-RADIATION ON MIXTURES OF BENZENE AND CARBON TETRACHLORIDE WITH FLUORINE-CONTAINING COMPOUNDS. A. V. Zimin, S. V. Churmanteev and A. D. Verina (L. Ia. Karpov Physicochemical Inst.). p.209-11 of "The Radiation Chemistry of Simple Organic Systems."

It was established that during the action of γ-radiation on mixtures of CCl_4 with inorganic fluorides and on mixtures of C_6H_6 and very simple fluorocarbons fluorination of CCl_4 and C_6H_6 occurs. The fluorination of CCl_4 proceeds by the substitution of chlorine atoms by fluorine atoms, while the presence of oxygen in the mixture increases the yield of fluorinated products. The fluorination of benzene proceeds by the substitution of hydrogen atoms by fluorine-containing radicals, which increases the number of carbon atoms in the fluorinated molecule. (W.L.H.)

22123
THE PROSPECTS OF PREPARING HEXACHLOROCYCLOHEXANE USING IONIZING RADIATION. P. V. Zimakov, E. V. Volkova, and L. A. Krasnousov. p.213-15 of "The Radiation Chemistry of Simple Organic Systems."

Results of experiments on the chlorination of benzene under the action of various forms of radiation over the temperature range of −80 to 40°C are presented. (W.L.H.)

22124
DETERMINATION OF THE INDIVIDUAL PRODUCTS OF THE RADIATION-OXIDATION OF N-HEPTANE AND ISOOCTANE (2,2,4-TRIMETHYLPENTANE). V. V. Saraeva, N. A. Bakh, L. V. Rybin, and V. A. Larin (Moscow State Univ.). p.217-21 of "The Radiation Chemistry of Simple Organic Systems."

Data are presented on the identification and accumulation of carbonyl compounds and acids, formed in n-heptane and isooctane. The oxidation of n-heptane and isooctane under the action of x radiation was investigated using a dose strength of 2×10^{16} to 3×10^{16} ev/ml x sec, t = 25°C, and with the continuous passage of oxygen. The radiation chemical yields of carbonyl compounds and acids in n-heptane and isooctane are tabulated. (W.L.H.)

22125
OXIDATION OF METHANE WITH OXYGEN UNDER THE EFFECT OF FAST ELECTRONS. B. M. Mikhailov, M. E. Kuimova, and V. S. Bogdanov (Organic Chemistry Inst., Academy of Sciences, U.S.S.R.). p.223-7 of "The Radiation Chemistry of Simple Organic Systems."

The investigation is devoted to the study of the oxidation of methane by oxygen under the action of a beam of fast electrons. A study was made of the following factors on the oxidation process; the molar ratio of components, pressure, temperature, and irradiation time. The CO, CO_2, CH_4, C_2H_6, C_2H_4, C_2H_2, $C_3H_8 + C_4H_8$, O_2, and H_2 were determined in the gaseous reaction products and water, peroxides, aldehydes, and acids were determined in the condensate. (W.L.H.)

22126
OXIDATION OF N-HEXADECANE UNDER THE EFFECT OF Co^{60} γ-RADIATION. Yu. (Iu.) L. Khmel'nitskii, M. A. Proskurnin, E. V. Barelko, I. I. Melekhonova, and A. T. Slepneva. p.229-32 of "The Radiation Chemistry of Simple Organic Systems."

The present work is devoted to the oxidation of paraffinic hydrocarbons under the action of γ radiation. It is shown that oxidation of n-hexadecane is sharply accelerated by the action of powerful sources of γ radiation. The composition of the oxidation products (acids, peroxide, carbonyl compounds, alcohols, and esters) was investigated. (W.L.H.)

22127
THE EFFECT OF IONIZATION DENSITY ON THE RADIOLYSIS OF HYDROCARBONS. I. V. Vereshchinskii and N. A. Bakh (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). p.233-5 of "The Radiation Chemistry of Simple Organic Systems."

A series of investigations devoted to the radiation-oxidation of organic compounds is presented. Benzene and cyclohexane containing molecular oxygen were sealed in ampules and irradiated in a heavy water reactor. Radiation chemical yields of benzene and cyclohexane radiolysis products are presented. (W.L.H.)

22128
SYNTHESIS AND REACTIONS OF LEUCO COMPOUNDS OF DYES UNDER THE EFFECT OF Co^{60} γ-RADIATION. I. V. Vereshchinskii, L. T. Karpushkin, and V. N. Shcheglov (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). p.237-41 of "The Radiation Chemistry of Simple Organic Systems."

The radiation chemical conversion of both solutions of individual leuco compounds of triarylmethane dyes and of a solution of the leuco compound dye Indophenol Blue, formed by the action of γ radiation on α naphthol and p-phenylenediamine, was studied. (W.L.H.)

22129
THE EFFECT OF RADIATION OF POLYMERS. Part VI of Proceedings of the First All-Union Conference on Radiation Chemistry, Moscow, 1957. (In English Translation). New York, Consultants Bureau, Inc., 1959. 48p. $25.00.

Nine papers are presented in this section of the Radiation Chemistry Conference. Separate abstracts have been prepared for each paper. (W.L.H.)

22130
INVESTIGATION OF THE CHEMICAL CHANGES OCCURRING IN SOME VINYL POLYMERS UNDER THE EFFECT OF IONIZING RADIATION. N. A. Slovokhotova (L. Ia. Karpov Physicochemical Inst.). p.249-53 of "The Effect of Radiation on Polymers."

The results obtained in an investigation of the changes in the infrared absorption spectra of polyisobutylene during irradiation in vacuum and polyethylene during irradiation in a carbon dioxide atmosphere, are given. (W.L.H.)

22131
THE FORMATION OF CROSS-LINKS DURING THE IRRADIATION OF POLYETHYLENE WITH IONIZING RADIATION. A. N. Pravednikov and S. S. Medvedev (L. Ia. Karpov Physicochemical Inst.). p.255-65 of "The Effect of Radiation on Polymers."

An investigation of the kinetics of polyethylene cross-linking showed that the rate of this process was constant with time and was proportional to the radiation intensity in the first stage. The simplest hypothesis is that the formation of cross-links during radiolysis occurs as a result of the recombination of polymer radicals formed by the rupture of C—H bonds by the radiation, and also as a result of the addition of polymer radicals to double bonds of polymer molecules. (W.L.H.)

22132

PHASE CONVERSIONS IN POLYMERS UNDER THE EFFECT OF NUCLEAR RADIATION. B. I. Zverev, V. L. Karpov, and S. S. Leschenko (L. Ia. Karpov Physicochemical Inst.). p.259-62 of "The Effect of Radiation on Polymers."

Disordering processes in the crystalline part of polymers occur in crystalline polymers of extremely diverse types. The reasons for the disordering are the chemical changes in molecules under irradiation, which result in sharp changes in the interatomic distances and breakdown of structural order in macromolecules. The amount of absorbed energy which is needed for complete disordering of the crystalline part depends on the nature of the polymer. (W.L.H.)

22133

INVESTIGATION OF GAS EVOLUTION FROM THE ACTION OF NUCLEAR RADIATION ON POLYMERS. I. Ia. Petrov and V. L. Karpov (L. Ia. Karpov Physicochemical Inst.). p. 263-7 of "The Effect of Radiation on Polymers."

An investigation of the amount and composition of gas liberated during irradiation of some polymers is presented. The gas yield during the radiolysis of polymers of various molecular structures changes over very wide limits, from 0.03 for polystyrene to 2.2 molecules/100 ev for polyethylene. The presence of phenyl and nitride groups in the chain had the greatest protective effect with respect to gas evolution. In the radiolysis of polyethylene, polystyrene, and rubbers, H_2 was mainly evolved and the rest of the gaseous fraction was CH_4, C_2H_6, and C_3H_8. Decomposition of polymethyl methacrylate, polyamide, polyacrylonitrile and stearic acid occurred mainly at the polar groups, indicating the possibility of the transfer of excitation energy to the chain. (W.L.H.)

22134

THE RULES OF RADIATION DECOMPOSITION OF GLASS-LIKE POLYMERS. B. L. Tsetlin, N. G. Zaitseva, V. M. Korbut, and V. A. Kargin (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). p.269-70 of "The Effects of Radiation on Polymers."

The methods of decomposition of glass-like polymers are described. (W.L.H.)

22135

THE ROLE OF GAS EVOLUTION IN THE DECOMPOSITION OF POLYMERS BY RADIATION. A. B. Taubman and L. P. Ianova (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). p.271-4 of "The Effect of Radiation on Polymers."

The effect of gas evolution on the decomposition of polymers subjected to ionizing radiation was investigated. Radiation may transform the polymer into a state of a viscous liquid. The first stage of gas evolution is the production of fissures in the zone of maximum absorption of electron energy. The fissures already formed as a result of gas evolution produce a fall in the supersaturation of the solutions due to excess gas formed and escaping into them. (W.L.H.)

22136

RADIATION VULCANIZATION OF RUBBER. T. S. Nikitina, A. S. Kuz'minskii, L. A. Oksent'evich, and V. L. Karpov (Inst. of Rubber Industry). p.275-9 of "The Effect of Radiation on Polymers."

An investigation was made of the irradiation cross-linking of a series of rubbers and some peculiarities of this process were noted. The activity of both lamp and channel blacks in the radiation vulcanization was demonstrated. (W.L.H.)

22137

THE STRUCTURE AND PROPERTIES OF VULCANIZATES OBTAINED BY THE ACTION OF NUCLEAR RADIATION. Z. N. Tarasova, M. Ia. Kaplunov, and B. A. Dogodkin (Tire Industry Inst.). p.283-7 of "The Effect of Radiation on Polymers."

Experimental data are presented characterizing the structure and properties of vulcanizates, obtained by radiation vulcanization in a nuclear reactor. Films 0.1 to 0.2 mm thick were prepared on cellophane from the sol fraction of benzene solutions of the rubbers. In radiation vulcanization under oxygen-free conditions, the films were placed in glass ampules, pumped out, and the ampules filled with purified N_2, sealed and placed in cans. The character of the vulcanization bonds in rubber vulcanized by irradiation was determined. (W.L.H.)

22138

RADIATION SOURCES. Part VII of Proceedings of the First All-Union Conference on Radiation Chemistry, Moscow, 1957. (In English Translation). New York, Consultants Bureau, Inc., 1959. 18p. $10.00.

Three papers are presented in this section of the Radiation Chemistry Conference. Separate abstracts have been prepared for each paper. (W.L.H.)

22139

SOURCES OF IONIZING RADIATION FOR RADIATION CHEMICAL INVESTIGATIONS. V. I. Zatulovskii, N. I. Vitushkin, D. I. Nariadchikov, and V. I. Petrovskii (Inst. of Physical Chemistry, Academy of Sciences, U.S.S.R.). p.295-8 of "Radiation Sources."

Two types of radiation sources were developed for use in radiation chemistry. One was an x-ray source and the other was a gamma source. A detailed description is given of both sources. (W.L.H.)

22140

SMALL-SCALE TESTING OF ISOTOPIC RADIATION SOURCES OF POSSIBLE INDUSTRIAL RADIATION CHEMICAL EQUIPMENT. I. INVESTIGATION OF THE DOSE FLUX IN THE WORKING CHAMBER OF THE K-1400 APPARATUS. Yu. (Iu.) S. Riabukhin and A. Kh. Breger (L. Ia. Karpov Physicochemical Inst.). p.299-304 of "Radiation Sources."

Some general problems in the small-scale testing of radiation sources for radiation chemical purposes are considered. Formulas are derived to calculate the two important characteristics of the intensity flux of a cylindrical source of finite dimensions. Comparisons of the calculated intensities with experiments, performed by a method developed for this purpose, showed that the maximum deviation was 8%. (auth)

22141

THE PRODUCTION OF ELECTRON PULSE RADIATION ON A LINEAR ACCELERATION TUBE. P. Ia. Glazunov and M. G. Kuz'min (Inst. of Physical Chemistry, Acad-

emy of Sciences, U.S.S.R.). p.305-7 of "Radiation Sources."

A method is presented for obtaining pulses of electron radiation on a normal vacuum tube of a linear accelerator, which is fed by a rectifier-condenser cascade of a 1.2 Mv voltage multiplier. (W.L.H.)

22142

IRRADIATION OF WAX. (to Esso Research and Engineering Co.). British Patent 821,114. Sept. 30, 1959.

The irradiation of waxes to increase n-paraffin content and adjust the properties to desired values is described. In the example, a wax melting at 132/134°F and containing 0.14 wt. % oil, 92.5 wt. % n-paraffins, 6.0 wt. % i-parrifins, and 1.5 wt. % naphthenes was irradiated. The irradiation, at 85°F, consisted of exposures of 1, 3, 8, and 168 hours to gamma and neutron irradiation. The data show drops in m.p. and viscosity after 1 hr, n-paraffin content drop after 1 hr, and a great increase in Br No. at 168 hrs. (T.R.H.)

22143

LARGE SCALE METHOD FOR THE PRODUCTION AND PURIFICATION OF CURIUM. Gary H. Higgins and William W. T. Crane (to U. S. Atomic Energy Commission). U. S. Patent 2,887,358. May 19, 1959.

A large-scale process for production and purification of Cm^{242} is described. Aluminum slugs containing Am^{241} are irradiated and declad in a $NaOH-NaNO_3$ solution at 85 to 100°C. The resulting slurry filtered and washed with NaOH, NH_4OH, and H_2O. Recovery of Cm from filtrate and washings is effected by an $Fe(OH)_3$ precipitation. The precipitates are then combined and dissolved in HCl and refractory oxides centrifuged out. These oxides are then fused with Na_2CO_3 and dissolved in HCl. The solution is evaporated and LiCl solution added. The Cm, rare earths, and anionic impurities are adsorbed on a strong-base anion exchange resin. Impurities are eluted with LiCl–HCl solution, rare earths and Cm are eluted by HCl. Other ion exchange steps further purify the Cm. The Cm is then precipitated as fluoride and used in this form or further purified and processed. (T.R.H.)

Separation Processes for Pu and U

22144 ANL-6029

Argonne National Lab., Lemont, Ill.

CHEMICAL ENGINEERING DIVISION SUMMARY REPORT [FOR] APRIL, MAY, JUNE 1959. Sept. 1959. 144p. Contract W-31-109-eng-38. $2.75(OTS).

Chemical-Metallurgical Processing. A direct-cycle Pyrometallurgical fuel-reprocessing plant is being designed in conjunction with the EBR-II reactor. Studies were continued on processing of melt-refining residues (crucible skull material). Skull oxide reductions in Mg–Cd solutions are in progress. Methods of isolation of Pu from EBR-II blanket material are being examined. Cadmium containing ~2% U and 0.2% Mg is being circulated at 550°C by an electromagnetic pump. Solubilities of Ru, Ce, and La in Cd were measured at temperatures from 325 to 625°C; the solubility of U in Zn was measured at temperatures from 425 to 800°C. The high-Cd covers of the ternary systems Cd–U–Zn and Cd–U–Mg were investigated. Sixteen colorimetric combustions in oxygen were completed with natural MoS_2. Eight successful colorimetric combustions of Mo in F_2 were completed. Fuel Cycle Application of Volatility and Fluidization Techniques. Studies on the rates of fluorination of UO_2, as it would appear in irradiated fuels, are in progress. Equilibrium constants are being obtained at various temperatures for the dissociation reaction of PuF_6 to F_2 and PuF_4. A systematic study of the reaction of Ni with F_2 is in progress as a part of the study of metal reactions with fluorine. A fluid-bed volatility process for the recovery of U from low-U–Zircaloy-2 fuel alloys is under development. A graphite dissolver-hydrofluorinator was given a shake-down test with a dummy fuel element. Feasibility studies on the calcination of simulated Purex process wastes were successful in providing a free-flowing, granular solid with a volume reduction factor of 4.7. Preliminary tests of a one-step, continuous fluid-bed process for the conversion of UF_6 to UO_2 were made in a 1½-in.-diam. Monel column. Reactor Safety. The pyrophoric nature of the reactor metals U, Zr, Th, and Pu are being investigated. The experimental program to determine rates of reaction of molten reactor fuel and cladding metals with water is continuing. A series of runs with U was completed. Reactor Chemistry. The decay characteristics of K^{42} and Te^{132} are being studied. Work has begun on a study of the reactions of superheated steam with metals, such as Zr, Zircaloys, and stainless steel. (For preceding period see ANL-5996.) (W.L.H.)

22145 CF-59-9-49

Oak Ridge National Lab., Tenn.

PRFR PILOT PLANT: AN EVALUATION OF EQUIPMENT PERFORMANCE DURING THE PROCESSING OF IRRADIATED NATURAL URANIUM IN APRIL 1959. J. L. Matherne. Sept. 15, 1959. 22p. $4.80 (ph), $2.70(mf) OTS.

The Power Reactor Fuel Reprocessing complex and the equipment performance during the processing of irradiated natural uranium fuel are described. Equipment performance was generally satisfactory for rates up to 400 kg of uranium per day. Low (at times $<10^3$) fission product decontamination factors obtained in the co-decontamination cycle resulted in increased radiation levels in normal operating areas; corrective measures planned are presented. Three cases in which equipment malfunctioning significantly affected the process, and the scheduled modifications, are discussed; these cases were the overconcentration of uranium in an evaporator, the rupture of a diaphragm in an intercycle process transfer pump, and erratic solvent flow control to the co-decontamination cycle. (auth)

22146 HW-21103(Del.)

Hanford Works, Richland, Wash.

RETENTION OF IODINE IN PROCESS SOLUTIONS BY MERCURIC SALTS. C. H. Holm. June 15, 1951. Decl. with deletions July 7, 1959. 22p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

Of the complexing agents tried, Hg(II), Cu(II), Zn(II), Pb(II), Bi(III), and Ag(I), only Hg(II) was effective in preventing the evolution of iodine from a simulated dissolver solution by air sparging. The presence of 10^{-4}M $Hg(NO_3)_2$ in simulated dissolver solution effectively prevented the evolution of iodine by vigorous air sparging in all process steps prior to extraction. Evolution of iodine during initial phases of a simulated slug dissolving, although decreased substantially, was not completely prevented by the presence of mercuric nitrate. The Hg did not plate onto stainless steel or metallic U from dissolver solution nor did it have any detectable effect on the rate at which metallic U dis-

solved in nitric acid. Corrosion of stainless steel by boiling dissolver solution proceeded at a negligible rate when Hg was present. The presence of mercuric nitrate in a simulated metal waste had no effect on disengaging times or U distribution in extraction and scrub studies made under expected TBP-RA column conditions. (auth)

22147 HW-55893(Del.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
THE RECOVERY, PURIFICATION, AND CONCENTRATION OF PLUTONIUM BY ANION EXCHANGE IN NITRIC ACID. J. L. Ryan and E. J. Wheelwright. Jan. 2, 1959. Decl. with deletions June 25, 1959. 104p. Contract W-31-109-Eng-52. $16.80(ph), $5.70(mf) OTS.

A detailed experimental study has shown absorption of plutonium(IV) from 7 M HNO_3 solutions by strong-base (quaternary amine) anion exchange resins to be a very powerful and versatile processing method for plutonium. The simple expedient of operating at 50 to 60°C relieves most of the objections of former anion exchange processes for plutonium in that it permits adequate processing rates and efficiency to be obtained with four per cent cross-linked resins. Commercially available strong-base anion exchange resins Dowex-1, X-4 (50 to 100 mesh), among 50 to 100 mesh resins, and Permutit SK (20 to 50 mesh), among 20 to 50 mesh resins, are markedly superior for most process applications. The anion exchange process consists of an absorption or loading step in which plutonium is absorbed out of a feed solution by the resin, a washing step in which impurities are removed by washing the plutonium-laden resin with an appropriate wash solution, and an elution step in which plutonium is stripped off the resin in an appropriate aqueous solution. The effects of the pertinent variables in each of these steps have been studied in some detail, yielding information which can be readily extrapolated to new processing applications. (auth)

22148 K-1366
Oak Ridge Gaseous Diffusion Plant, Tenn.
RECOVERY OF URANIUM HEXAFLUORIDE FROM A PROCESS GAS STREAM BY ABSORPTION-DISTILLATION TECHNIQUES EMPLOYING A LIQUID FLUOROCARBON MEDIUM. R. A. Ebel, C. C. Littlefield, D. C. Brater, and S. H. Smiley. Oct. 15, 1959. 36p. Contract W-7405-eng-26. $1.00(OTS).

Complete recovery of uranium hexafluoride from a nitrogen-uranium hexafluoride mixture was accomplished with a packed column absorption-distillation system employing perfluorodimethylcyclohexane, C_8F_{16}, as the sorbent. The pilot plant operated well on a continuous basis, and the limiting gas and liquid rates agreed well with those predicted from standard correlations. For absorption, values of the height of a transfer unit varied from 1.5 to 2.0 feet for $\frac{3}{8}$-inch aluminum Raschig rings, and for distillation, the height of a theoretical plate at 50% flooding was 1.2 feet for $\frac{1}{2}$-inch Monel Raschig rings. (auth)

22149 M-6862
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
IDAHO CHEMICAL PROCESSING PLANT PROJECT COMPLETION REPORT. D. R. Rogers and B. B. Schroeder. Dec. 1955. 158p., 3 ills. $30.30(ph), $8.70(mf) OTS.

The data presented were prepared from data contained in the as-built drawings and available contract documents, cost reports, and from general information. Costs as shown are assumed to be actual and final costs for the basic project and were obtained from cost documents. Equipment listings are reported. All equipment is listed under the building in which it is installed without regard to location of the particular system to which it belongs or to the function which it serves. Total design costs were prorated against each building using total costs as shown in the cost documents. (W.L.H.)

22150 NP-7884
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
PLANT UTILITIES. Technical Report 42, Chapter 170. O. Jenne and R. Winckler. [1959]. 14p. $3.30(ph), $2.40(mf) OTS.

Utilities for the Eurochemic Plant are described. Data are included as are plant lay-out diagrams. (J.R.D.)

22151 NP-7894
European Company for the Chemical Processing of Irradiated Fuels, Mol, Belgium.
PRELIMINARY CRITICALITY STUDY. Technical Report No. 52, Chapter 260. G. Calleri, M. Lung, and M. Zifferero. [1959]. 74p. $12.30(ph), $4.50(mf) OTS.

A brief study is presented of criticality control and parameters for the proposed 100 ton per year Eurochemic radiochemical processing plant. (W.L.H.)

22152 OMCC-HEF-159
Olin Mathieson Chemical Corp., Niagara Falls, N. Y.
HYDROGENATION OF LITHIUM. PART I. PREPILOT BATCH PROCESS. J. H. Seep. Dec. 26, 1958. 126p. AMC Project No. 7-558C. Contract AF33(600)-33920. (AD-218343).

The two methods of synthesis investigated during the batch program were the direct hydrogenation of lithium metal and the oil dispersion method. The direct hydrogenation program was carried out in a batch reactor with and without agitation. Several experiments were performed and conversions as high as 80 per cent were obtained. However, the temperatures required (750–930°F), the equipment problems involved, and the development time necessary made this method less desirable. The major effort was concentrated on the oil dispersion method. The investigation included studies of reactor geometry, agitation, catalysis, raw materials, temperature, pressure, reaction kinetics, particle size, dispersion agents and corrosion. Over 1300 experiments were performed using statistical methods to correlate data where possible and a reaction mechanism was developed and postulated from the bench scale data. (auth)

22153
THE INDUSTRIAL METHODS OF THE LOW-GRADE URANIUM ORES REFINEMENT. G. E. Kaplan, B. N. Laskorin, and B. V. Nevskii. Atomnaya Energ. 6, 113-23(1959) Feb. (In Russian)

A review is presented on progress in the technology of uranium ore refinement. About 70% of all uranium is produced by extraction from solutions by sorption on resins. Uranium extraction by leaching is also discussed. Mechanical enrichment by gravitation, flotation, and radiometric enrichment are described. (tr-auth)

22154

MECHANISM OF THE PLUTONIUM NITRATE EXTRACTION BY MONO- AND DIBUTYL PHOSPHATES. V. B. Shevchenko and V. S. Smelov. Atomnaya Energ. 6, 140-4(1959) Feb. (In Russian)

The mechanism of plutonium nitrate extraction by mono- and dibutyl phosphates (MBP and DBP) is described. It is shown that plutonium is extracted as PuK_4. Where K is $[(C_4H_9)_2PO_4]^-$ or $[C_4H_9HPO]_4^-$. The equilibrium constant with MBP is $(1.5 \pm 0.25) \times 10^3$ and with DBP is $(6.15 \pm 0.85) \times 10^3$. (tr-auth)

22155

URANIUM-233. FORMATION IN REACTORS. PURIFICATION CYCLE. André Chesné (École de Physique et de Chimie Industrielles, Paris). Énergie nucléaire 1, 177-84(1959) July-Aug. (In French)

The irradiation of Th^{232} in a reactor gives rise to the formation of U^{233}, Pa^{233}, and fission products. In order to utilize the untransformed Th^{232} as a fertile material and U^{233} as a fissionable material, it is necessary to eliminate foreign elements capable of absorbing neutrons and gamma emitters which complicate their handling. The most favorable experimental conditions for the chemical treatment are defined. The process includes the solution of metallic thorium, decontamination of uranium, separation of uranium and thorium, reextraction of uranium, concentration and purification, and recovery of Pa^{233}. (tr-auth)

22156

THE INVESTIGATION OF ANALYTIC PROPERTIES OF THE BINARY FLUORIDE OF URANIUM(IV) AND AMMONIUM. Ye. R. Nikolayeva. Vestnik Moskov. Univ., Ser. Mat. Mekh. Astron. Fiz. i Khim. 13, No. 4, 193-6(1958).

The influence of acidity, the concentration of the precipitant, and other factors on the completeness of uranium (IV) precipitation by ammonium fluorides is investigated. Fe^{2+} was used for the regeneration of uranium. Small quantities of uranium (0.5 to 2 mg) can be separated from vanadium, molybdenum, and iron with the aid of ammonium fluorides if the concentration of the solution is not too strong. (TCO)

22157

TREATMENT OF PLUTONIUM–ALUMINUM FUEL RODS. (to Atomic Energy of Canada, Ltd.). British Patent 820,660. Sept. 23, 1959.

A process is presented for Pu recovery from spent Pu–Al fuels. The fuel material is heated with Bi above the melting point, fission product concentration in the Bi phase, and separation of Bi phase. (T.R.H.)

22158

METHOD OF FORMING PLUTONIUM-BEARING CARRIER PRECIPITATES AND WASHING SAME. B. F. Faris (to U. S. Atomic Energy Commission). U. S. Patent 2,875,022. Feb. 24, 1959.

An improvement of the lanthanum fluoride carrier precipitation process for the recovery of plutonium is presented. In this process the plutonium is first segregated in the LaF_3 precipitate and this precipitate is later dissolved and the plutonium reprecipitated as the peroxide. It has been found that the loss of plutonium by its remaining in the supernatant liquid associated with the peroxide precipitate is greatly reduced if, before dissolution, the LaF_3 precipitate is subjected to a novel washing step which constitutes the improvement of this patent. The step consists in intimately contacting the LaF_3 precipitate with a 4 to 10 percent solution of sodium hydrogen sulfate at a temperature between 10 and 95°C for ½ to 3 hours.

22159

RECOVERY OF URANIUM VALUES. Keith B. Brown, D. J. Crouse, Jr., and J. G. Moore (to U. S. Atomic Energy Commission). U. S. Patent 2,877,250. Mar. 10, 1959.

A liquid-liquid extraction method is presented for recovering uranium values from an aqueous acidic solution by means of certain high molecular weight amine in the amine classes of primary, secondary, heterocyclic secondary, tertiary, or heterocyclic tertiary. The uranium bearing aqueous acidic solution is contacted with the selected anine dissolved in a nonpolar water-immiscible organic solvent such as kerosene. The uranium which is substantially completely extracted by the organic phase may be stripped therefrom by water, and recovered from the aqueous phase by treatment into ammonia to precipitate ammonium diuranate.

22160

PROCESS FOR RECOVERYING URANIUM. G. E. MacWood, Coleman D. Wilder, and D. Altman (to U. S. Atomic Energy Commission). U. S. Patent 2,879,130. Mar. 24, 1959.

A process useful in recovering uranium from deposits on stainless steel liner surfaces of calutrons is presented. The deposit is removed from the stainless steel surface by washing with aqueous nitric acid. The solution obtained containing uranium, chromium, nickel, copper, and iron is treated with an excess of ammonium hydroxide to precipitate the uranium, iron, and chromium and convert the nickel and copper to soluble ammonio complexions. The precipitated material is removed, dried and treated with carbon tetrachloride at an elevated temperature of about 500 to 600°C to form a vapor mixture of UCl_4, UCl_5, $FeCl_3$, and $CrCl_4$. The UCl_4 is separated from this vapor mixture by selective fractional condensation at a temperature of about 300 to 400°C.

22161

VOLATILE FLUORIDE PROCESS FOR SEPARATING PLUTONIUM FROM OTHER MATERIALS. F. H. Spedding and A. S. Newton (to U. S. Atomic Energy Commission). U. S. Patent 2,882,125. Apr. 14, 1959.

The separation of plutonium from uranium and/or fission products by formation of the higher fluorides of uranium and/or plutonium is described. Neutron-irradiated uranium metal is first converted to the hydride. This hydrided product is then treated with fluorine at about 315°C to form and volatilize UF_6 leaving plutonium behind. The plutonium may then be separated by reacting the residue with fluorine at about 500°C and collecting the volatile plutonium fluoride thus formed.

22162

PLUTONIUM PURIFICATION PROCESS EMPLOYING THORIUM PYROPHOSPHATE CARRIER. Edward L. King (to U. S. Atomic Energy Commission). U. S. Patent 2,884,305. Apr. 28, 1959.

The separation and purification of plutonium from the radioactive elements of lower atomic weight is described. The process of this invention comprises forming a 0.5 to 2 M aqueous acidic solution containing plutonium ions in the tetravalent state and elements with which it is normally contaminated in neutron irradiated uranium, treating the solution with a double thorium compound and a soluble pyrophosphate compound

($Na_4P_2O_7$) whereby a carrier precipitate of thorium pyrophosphate is formed in the solution, separating, and redissolving the thorium pyrophosphate precipitate together with the tetravalent plutonium carried with the precipitate, treating the solution with hydroxylamine to reduce tetravalent plutonium into the trivalent state, and reprecipitating and separating the thorium pyrophosphate leaving the trivalent plutonium in the solution in a substantially pure state.

22163

RECOVERY OF PLUTONIUM AND NEPTUNIUM FROM AQUEOUS SOLUTIONS. Glenn T. Seaborg, Roy C. Thompson, and Frederic W. Albaugh (to U. S. Atomic Energy Commission). U. S. Patent 2,886,406. May 12, 1959.

A method is presented of reducing neptunium and plutonium to a +4 state of oxidation so that plutonium may be carried with bismuth phosphate from a solution containing uranyl ion and fission products. The reduction process consists of treating a nitric acid solution of neutron irradiated uranium with oxalate ions, manganous ions, and fluoride ions. The presence of any sodium nitrite is advantageous since it destroys any hydrazine formed in the reduction of nitric acid and assures the more complete carrying of plutonium. The reduction is carried out for 1 hour at 15°C in the presence of 0.09 molar oxalic acid, 0.0075 to 0.01 molar Mn^{++} ions and 0.02 molar $(NH_4)_2SiF_6$. Sodium nitrite to the extent of 0.1 molar may also be present under these conditions. 98% of the plutonium is carried by the bismuth phosphate precipitate.

22164

TREATMENT OF PLUTONIUM SOLUTION WITH NO OR NO_2 PRIOR TO REMOVAL OF TETRAVALENT PLUTONIUM FROM SAID SOLUTION BY CARRIER PRECIPITATION. G. E. Moore (to U. S. Atomic Energy Commission). U. S. Patent 2,886,407. May 12, 1959.

A process is presented for the separation of plutonium from fission products carried therewith when plutonium in the reduced oxidation state is removed from a nitric acid solution of irradiated uranium by means of bismuth or lanthanum phosphate as a carrier percipitate. It is known that in plutonium containing solutions prepared by dissolving neutron irradiated uranium in nitric acid the plutonium is at least partially converted to a non-carriable state apparently by the presence of some intermediate reduction product produced by the reduction of nitric acid, such as for example hydrazine, which tends to form a soluble complex therewith. According to the invention such a complex can be avoided by introducing oxides of nitrogen such as nitrogen dioxide into the nitrogen acid solution of neutron irradiated uranium preferably at elevated temperatures as for example 50 to 85% C, prior to the removal of plutonium by the use of a carrier. By this procedure plutonium can be recovered in amounts which represent about 90% when the resulting solution is treated in accordance with known carrier methods referred to above.

22165

ENHANCING PRECIPITATIONS BY APPLYING SOLUBLE COMPLEX FLUORINE-CONTAINING REAGENTS. G. W. Stahl (to U. S. Atomic Energy Commission). U. S. Patent 2,886,408. May 12, 1959.

The use of fluo-reagents in processes for the recovery of transuranic elements such as plutonium for the purpose of complexing zirconium, columbium, and uranium so that they can be removed from solutions in which they are contained is described. In the carrier precipitation process for the separation of plutonium from uranium and fission products including zirconium and columbium, the precipitated bismuth phosphate carries some zirconium, columbium, and uranium impurities. According to the invention such impurities can be complexed and removed by dissolving the contaminated carrier precipitate in 10M nitric acid, followed by addition of fluosilicic acid to about 1M, diluting the solution to about 1M in nitric acid, and then adding phosphoric acid to re-precipitate bismuth phosphate carrying plutonium.

22166

IMPROVED PROCESSES FOR RECOVERING AND PURIFYING URANIUM. T. D. Price and A. V. Henrickson (to U. S. Atomic Energy Commission). U. S. Patent 2,886,409. May 12, 1959.

A process is described for reclaiming metallic uranium enriched with uranium-235 from the collector of a calutron upon which the enriched metallic uranium is deposited. In particular, it relates to a process for reclaiming uranium from substances containing uranium and impurities including iron, nickel, chromium, and copper. According to the invention, a nitric acid wash solution containing uranium and the impurities is added to hydrochloric acid to form a 3 to 6 normal solution containing $UO_2^{+2}Ni^{+2}Fe^{+3}Cu^{+2}Cr^{+3}$ ions and a small amount of NO_3 ions. The solution, subjected to the reducing action of a liquid amalgam prepared from mercury and zinc, is converted to a solution of $U^{+4}Fe^{+2}Cr^{+}3Zr^{+3}$ ions. In the reduction step, the NO_3 ion is destroyed while the Cu and Ni ions are reduced to metals and precipitated with the spent amalgam. The solution, separated from the spent amalgam, is then treated with oxalic acid to selectively precipitate uranous oxalate.

22167

IMPROVED PROCESS OF PLUTONIUM CARRIER PRECIPITATION. B. F. Faris (to U. S. Atomic Energy Commission). U. S. Patent 2,892,676. June 30, 1959.

This patent relates to an improvement in the bismuth phosphate process for separating and recovering plutonium from neutron irradiated uranium, resulting in improved decontamination even without the use of scavenging precipitates in the by-product precipitation step and subsequently more complete recovery of the plutonium in the product precipitation step. This improvement is achieved by addition of fluomolybdic acid, or a water soluble fluomolybdate, such as the ammonium, sodium, or potassium salt thereof, to the aqueous nitric acid solution containing tetravalent plutonium ions and contaminating fission products, so as to establish a fluomolybdate ion concentration of about 0.05 M. The solution is then treated to form the bismuth phosphate plutonium carrying precipitate.

22168

SEPARATION OF URANIUM FROM THORIUM AND PROTACTINIUM. W. K. R. Musgrave (to U. S. Atomic Energy Commission). U. S. Patent 2,892,677. June 30, 1959.

This patent relates to the separation of uranium from thorium and protactinium; such mixtures of elements usually being obtained by neutron irradiation of thorium. The method of separating the constituents has been first to dissolve the mixture of elements in concentrated

nitric acid and then to remove the protactinium by absorption on manganese dioxide and the uranium by solvent extraction with ether. Prior to now, comparatively large amounts of thorium were extracted with the uranium. According to the invention this is completely prevented by adding sodium diethyldithiocarbamate to the mixture of soluble nitrate salts. The organic salt has the effect of reacting only with the uranyl nitrate to form the corresponding uranyl salt which can then be selectively extracted from the mixture with amyl acetate.

22169

METHOD OF MAINTAINING PLUTONIUM IN A HIGHER STATE OF OXIDATION DURING PROCESSING. S. G. Thompson and D. R. Miller (to U. S. Atomic Energy Commission). U. S. Patent 2,892,678. June 30, 1959.

This patent deals with the oxidation of tetravalent plutonium contained in an aqueous acid solution together with fission products to the hexavalent state, prior to selective fission product precipitation, by adding to the solution bismuthate or ceric ions as the oxidant and a water-soluble dichromate as a holding oxidant. Both oxidant and holding oxidant are preferably added in greater than stoichiometric quantities with regard to the plutonium present.

22170

PYROCHEMICAL DECONTAMINATION METHOD FOR REACTOR FUEL. A. G. Buyers (to U. S. Atomic Energy Commission). U. S. Patent 2,892,701. June 30, 1959.

A pyro-chemical method is presented for decontaminating neutron irradiated uranium and separating plutonium therefrom by contact in the molten state with a metal chloride salt. Uranium trichloride and uranium tetrachloride either alone or in admixture with alkaline metal and alkaline earth metal fluorides under specified temperature and specified phase ratio conditions extract substantially all of the uranium from the irradiated uranium fuel together with certain fission products. The phases are then separated leaving purified uranium metal. The uranium and plutonium in the salt phase can be reduced to form a highly decontaminated uranium-plutonium alloy. The present method possesses advantages for economically decontaminating irradiated nuclear fuel elements since irradiated fuel may be processed immediately after withdrawal from the reactor and the uranium need not be dissolved and later reduced to the metallic form. Accordingly, the uranium may be economically refabricated and reinserted into the reactor.

22171

RECOVERY OF URANIUM BY CYCLOALKYLDITHIOCARBAMATE COMPLEXING. O. K. Neville (to U. S. Atomic Energy Commission). U. S. Patent 2,892,855. June 30, 1959.

The separation of uranium-233 from an aqueous nitric acid solution of neutron irradiated thorium by selectively complexing the uranium is described. The separation is carried out by contacting the thorium solution with a non-aromatic organic dithiocarbamate selected from the group which consists of alkali and alkaline earth cycloalkyldithiocarbamates and recovering the resulting uranyl cycloalkyldithiocarbamate complex by organic solvent extraction such as with methyl ethyl ketone. The complexed uranium may be stripped from the separated organic phase by scrubbing with one normal nitric acid solution.

CONTROLLED THERMONUCLEAR PROCESSES

22172 AD-209767

Massachusetts Inst. of Tech., Cambridge. Naval Supersonic Lab.

STUDIES OF PLASMA PHYSICS. Technical Report No. 353. Quarterly Progress Report No. 2 [for] August 1 – October 31, 1958. 5p. Project No. DSR 7931. Contract AF33(616)-5693.

A brief survey is presented on available literature covering the primary properties which characterize a gaseous plasma. (auth)

22173 AERE-L-107

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

LECTURES ON THE HYDROMAGNETIC STABILITY OF A CYLINDRICAL PLASMA. VI. POSSIBLE INFLUENCE OF PARTICLE MOTIONS ACROSS THE LINES OF FORCE. R. J. Tayler. June 1959. 17p. $0.35(BIS).

It has recently been shown by Rosenbluth and Suydam that the stabilized pinch may suffer from surface instabilities. These arise because, in a discharge with a current layer of finite thickness, perturbations can arise which affect the outer surface of the current layer but leave the inner surface unperturbed. For such perturbations the trapped axial field exerts little stabilizing influence. These surface instabilities are of a very localized character and rapidly enter a non-linear phase. In deriving these results it was assumed that the plasma is an ideal hydromagnetic fluid, which implies that particles are tied to the lines of magnetic force. In an actual plasma particles can move across lines of force in performing Larmor orbits and, in the case of surface instabilities, the distance moved may be comparable with the scale of the perturbation. If this is so the particles may exert a stabilizing influence. Some recent calculations by Hubbard, discussed in this lecture, suggest that these particle motions do have an important effect on stability. It would be very difficult to solve the full stability problem with particle motions introduced. Instead, Hubbard assumed that any particle is acted on by an average magnetic field, and by performing a suitable average he removed the singularity in the Euler-Lagrange equation. It was then found for a typical example that the discharge remains stable until the current layer has a thickness of about 20% of that of the discharge. Results are based on physical intuition rather than on mathematical rigor. (auth)

22174 CF-55-11-135

Oak Ridge National Lab., Tenn.

A COAXIAL DISCHARGE FOR MULTICHARGED IONS. John S. Luce. Nov. 15, 1955. Decl. Oct. 7, 1958. 5p. $1.80(ph), $1.80(mf) OTS.

In considering the problem of injection methods for Sherwood devices, coaxial discharges were studied. The major advantages of coaxial discharges when used for multiple ionization appear to be as follows: removal of low charge-state ions, efficient electron conservation and utilization, and low neutral pressure in the arc. (W.L.H.)

22175 MATT-Q-7
Princeton Univ., N. J. Project Matterhorn.
QUARTERLY REPORT COVERING THE PERIOD APRIL 1 – JUNE 30, 1959. 39p. Contract AT(30-1)-1238. $1.25(OTS).

With improved techniques, fluctuations of light, of magnetic field, and of particle density were all observed in B-1 at currents both above and below the Kruskal limit. While the evidence is not yet conclusive, the observations appear consistent with lateral motion of the discharge channel above the Kruskal limit (m = 1 perturbation). Below the Kruskal limit, the motion is qualitatively different, corresponding to distortion of the discharge channel without motion of the magnetic axis. Further exploration of these phenomena, which are roughly in agreement with theoretical expectations, should yield interesting information on plasma dynamics. Further work on B-3 confirms that the stabilizing windings do not affect the observed rate of decay of electron density in a hydrogen discharge (the pump-out effect). Considerable effort is planned to reduce the impurity level in this device with an Hg pumping system and a divertor; the chief practical problem produced by pump-out is the resulting high impurity level, which cools off the gas rapidly as soon as ohmic heating terminates. If the impurity level can be reduced appreciably by other means, pump-out may not be practically serious. Fabrication of components for the C stellarator is proceeding rapidly. It is expected that this complete system, except for the divertor and ion heating equipment, will be ready for preliminary operation by the summer of 1960. Theories of electrostatic instabilities are being intensively explored, in an attempt to explain the phenomena observed in the B-3 device. Both pump-out and the subsequent enhanced plasma impedance may result from instabilities of this sort. (For preceding period see MATT-Q-6.) (auth)

22176 NRL-5371
Naval Research Lab., Washington, D. C.
ENERGY PRODUCTION AND FUSION PRODUCTS FROM A THERMONUCLEAR PLASMA. W. R. Faust and A. D. Anderson. July 1, 1959. 38p. Project NR-550-000.

With the aid of the NRL computer, Narec, calculations were made giving the ion concentrations, neutron emission, energy density, and temperature as a function of time in deuterium-tritium and pure deuterium plasmas raised initially to temperatures near the thermonuclear "ignition" temperatures. The initial conditions chosen for a deuterium-tritium mixture were temperatures of 3.0, 3.5, 4.0, 4.5, and 5.0 kev, with both the deuterium and tritium ion concentrations being $10^{15}/cm^3$. The set of initial conditions chosen for pure deuterium was 10^{15} ions/cm^3 and temperatures of 15, 20, 25, 30, 35, 40, and 45 kev. The tables and graphs resulting from these preliminary calculations, in which the problem was idealized and other simplifying assumptions made, indicate an "ignition" temperature for the deuterium-tritium mixture somewhere between 3.0 and 3.5 kev and an "ignition" temperature for the pure deuterium between 15 and 20 kev. (auth)

22177 NYO-2544
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
SHERWOOD PROGRESS REPORT NO. 3 [FOR] JULY 1958 TO JULY 1959. H. Grad and J. Berkowitz. July 31, 1959. 19p. Contract AT(30-1)-1480. $3.30 (ph), $2.40(mf) OTS.

A summary of Sherwood activities at the Institute of Mathematical Sciences at NYU is presented. Brief summaries are given of the work on hydromagnetic wave propagation, particle orbits, shock theory, transport theory, equilibrium and stability, and cusped geometries. A complete bibliography of reports and papers published is included. (W.D.M.)

22178 NYO-8647
Stevens Inst. of Tech., Hoboken, N. J.
MEASUREMENTS ON A LOW-INDUCTANCE CAPACITOR. Ira Mansfield. May 2, 1958. 10p. Contract AT(30-1)-1921. $3.30(ph), $2.40(mf) OTS.

This report presents a series of measurements on the self-inductance of an energy storage capacitor rated at 1 μ fd, 50 kr d-c with various modes of connection. The lowest value measured is 0.015 μh, corresponding to a short-circuit ringing frequency of 1.3 Mc.

22179 ORNL-2745
Oak Ridge National Lab., Tenn.
PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. Oct. 7, 1959. 91p. Contract W-7405-eng-26. $2.25(OTS).

22180 ORNL-2745(p.1-6)
Princeton Univ., N. J. Project Matterhorn.
SOME OF THE THERMAL PROBLEMS INVOLVED IN THE DESIGN OF THE CONFINING FIELD COILS FOR THE C STELLARATOR. J. F. Arnaud. p.1-6 of PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 6p.

The axial field in the Model C Stellarator will be produced by a number of confining field coils placed along the 472 in. axis of the race track. These coils with 52 million ampere turns are designed to produce a field of 55,000-gauss in the volume enclosed by the vacuum vessel. Generator capacity to supply the energy for this field and for ohmic losses is ~200 Mw. A method is proposed for determining hot-spot temperatures by a semiaccurate determination of the thermal time constant of the coils. (W.D.M.)

22181 ORNL-2745(p.8-9)
Oak Ridge National Lab., Tenn.
MAGNETIC COIL DESIGN FOR DCX-1. E. S. Bettis. p.8-9 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 2p.

The failure of previous attempts to solve the problem of cooling the DCX-1 mirror-field coils by rifle drilling to provide for axial water flow led to the development of a new design. The design, construction, and cooling of the coil are discussed. (W.D.M.)

22182 ORNL-2745(p.10-12)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
MAGNETIC SWITCHING DEVICES. R. Carruthers. p.10-12 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 3p.

For a given switching duty it is a straightforward matter to calculate the size of the magnetic switch because of the small difference in peak flux swing avail-

able with suitable core materials. The core is then constructed from the lowest grade—and cheapest—material that will have a presaturation current within the capacity of the other circuit elements. A magnetic switch designed for use with Zeta reduced the electrical wear on the contacts of the associated mechanical switch to such a level that in the course of many tens of thousands of operations the wear was largely due to mechanical rubbing. (auth)

22183 ORNL-2745(p.13-15)
Princeton Univ., N. J. Project Matterhorn.
AN ANALOG BOARD FOR TIME-VARYING AXIAL SYMMETRICAL FIELDS. U. Christensen. p.13-15 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 3p.

An analog board has been contemplated that will simulate the electromagnetic response of any system consisting of axial symmetrical conductors. These conductors can be either shorted, opened, or energized by a time-varying voltage. On such a board one can, with the proper equipment, measure any desired magnetic or electrical quantity of the system. There are two types of electrical networks that would be accurate analogs for any axial symmetrical fields, one a discretizing of the actual space elements and the other a simple transform of the first one. (auth)

22184 ORNL-2745(p.15-19)
Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
PULSED MAGNETIC FIELDS. Simon Foner. p.15-19 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 5p.

The need for high magnetic fields in solid state research led to the development of pulsed-field magnets at Lincoln Laboratory. The pulsed field technique is most useful when extremely high fields are desired over small volumes, and when experimental observations can be made in a short time. Under such conditions efficient coils can be employed with no provision for external cooling. When continuous fields are desired, provisions for cooling require extensive modifications of coil design. The characteristics of two pulsed field coils are summarized; a helical design useful for experiments in relatively small volumes, and a flux-concentrator which may be applicable to high field generation over the large volumes required by thermonuclear machines. Although these developments were not directed toward thermonuclear research, some of the results may prove useful here. As an example the possibilities of a pulsed field Maser are described. (auth)

22185 ORNL-2745(p.19-21)
Oak Ridge National Lab., Tenn.
BOILING BURNOUT WITH VORTEX COOLANT FLOW. W. R. Gambill. p.19-21 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 3p.

Motivations for vortexing a boiling coolant in a high performance d-c magnet include: (a) higher velocity for equal flow rate, (b) inward radial vapor transport under the action of centrifugal acceleration, and (c) greater radial turbulent fluctuations. A generalized correlation for burnout with net boiling in straight flow is given. (W.D.M.)

22186 ORNL-2745(p.22-5)
California. Univ. [Livermore. Lawrence Radiation Lab.]
CONSTRUCTION AND FABRICATION FEATURES OF SOME MAGNET COILS USED IN FUSION STUDIES. E. I. Hill. p.22-5 of PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 4p.

The need for high-voltage, fast-rising pulse coils as used in magnetic mirror machines and for highly concentrated z field coils as used in certain pinch experiments has led to the development of some interesting types of coil construction. The methods used in constructing a one-unit mirror assembly used on the Table Top experiments at UCRL are described. Specific problems in coil construction are discussed. (W.D.M.)

22187 ORNL-2745(p.25-40)
Princeton Univ., N. J. Project Matterhorn.
DESIGN AND DEVELOPMENT EXPERIENCES WITH HIGH-TEMPERATURE STABILIZING WINDINGS FOR PROJECT MATTERHORN B-3 MACHINE. H. G. Johnson. p.25-40 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 16p.

The design and construction of several types of electrical windings which produce a helical magnetic field around the vacuum (plasma) tube of the B-3 thermonuclear research machine are described. These windings are constructed as an integral part of the vacuum tube and are designed to withstand the required vacuum tube bakeout temperature of 850°F. (auth)

22188 ORNL-2745(p.41-3)
Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
THE GENERATION OF HIGHER CONTINUOUS FIELDS. H. H. Kolm. p.41-3 of PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 3p.

Certain experiments in solid state physics of current interest require continuous magnetic fields of modest volume but of substantial intensity, preferably in the several hundred kilogauss range. The art of high-field generation was re-examined, with a view to designing continuously operating solenoid magnets of minimized volume, with particular emphasis upon access at the largest possible angular aperture, a feature of importance in connection with work in the far infrared. The most advantageous coolant was found to be water under nucleate boiling conditions. The construction of a Bitter solenoid is described. (W.D.M.)

22189 ORNL-2745(p.44-7)
Los Alamos Scientific Lab., N. Mex.
REFRIGERATION OF MAGNET COILS. H. L. Laquer. p. 44-7 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 4p.

Development of steady-field refrigerated magnets has been going on in the cryogenics group of LASL since Jan. 1955. A maximum steady field of 62 kilo-oersteds was achieved with a coil of 5-in. length, 2.5-in. ID, and 7.5-in. OD immersed in freely boiling hydrogen. Power dissipation was 15 kw. Recent efforts have been directed

toward obtaining a safe experimental arrangement, long-term operational experience, and preliminary work on magnetoresistance. Voltage taps were attached to two coils so that the average resistivity of various coil sections could be determined as a function of the current. (W.D.M.)

22190 ORNL-2745(p.48-50)
Air Force Cambridge Research Center. Geophysics Research Directorate, Mass.
THE PRODUCTION OF PULSED MAGNETIC FIELDS AT AFCRC. Morton A. Levine. p.48-50 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 3p.

For many applications, the use of pulsed currents to produce magnetic fields offers definite advantages over d-c methods. With pulsed currents one can produce larger fields of many varied shapes more simply and with considerably less equipment. Pulsed magnetic field production at AFCRC is discussed. (W.D.M.)

22191 ORNL-2745(p.51-9)
Princeton Univ., N. J. Project Matterhorn.
MAGNETIC FIELD DESIGN AND CONSTRUCTION EXPERIENCE AT PRINCETON. R. G. Mills. p.51-9 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 9p.

The Princeton Program is the development of the stellarator type of thermonuclear machine. Five problems in designing and constructing field systems are discussed: (1) determination of a physically realizable set of currents to produce the desired field shape, (2) design of coils to make efficient use of the stored energy available, (3) mechanical structure to support the forces produced, (4) cooling to remove electrical energy consumed, and (5) cooling of coils closely associated with baked-out components. (W.D.M.)

22192 ORNL-2745(p.59-61)
Princeton Univ., N. J. Project Matterhorn.
PROXIMITY EFFECT AND ITS IMPORTANCE TO THE PULSED FIELD DESIGNER. F. Tenney and D. R. Wells. p.59-61 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 3p.

A method is illustrated for computing the a-c resistance of infinitely long single and multiturn solenoids. (auth)

22193 ORNL-2745(p.61-7)
Princeton Univ., N. J. Project Matterhorn.
THE USE OF ANALOG COMPUTERS IN THE DESIGN OF MAGNETIC FIELD SYSTEMS. K. E. Wakefield. p.61-7 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 7p.

Analog devices used in the design and study of magnetic field configurations at Project Matterhorn are described briefly. The mathematical basis for each of these analogs is discussed. Other aids used in field calculations are digital computers (used primarily as a check) and flux charts. (auth)

22194 ORNL-2745(p.68-72)
California. Univ., Livermore. Lawrence Radiation Lab.
OPTIMIZATION OF D-C COIL DESIGN WITH RESPECT TO COIL FABRICATION COST AND COST OF INSTALLED D-C POWER. A. F. Waugh. p.68-72 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 5p.

The Project Sherwood experimental program at Livermore required an ample supply of relatively high field strength, modular, d-c magnet coils of several sizes. Since the design of these coils might become somewhat of a standard and the number to be ordered was fairly large with a good possibility of reorder in the future, it appeared worth while to try to optimize the design from an economic point of view, taking into account the cost of the d-c power installation required as well as the fabrication costs of the coils themselves. (auth)

22195 ORNL-2745(p.72-4)
California. Univ., Livermore. Lawrence Radiation Lab.
SOME ASPECTS OF HEAT DISSIPATION FROM ALUMINUM-FOIL COILS. A. F. Waugh. p.72-4 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 3p.

Livermore became interested in aluminum-foil coils for use as d-c field coils, primarily because of the inherent relatively high impedance of this type of coil. The conductor of an Al-foil coil is a thin aluminum ribbon $\frac{1}{2}$ to several mils thick. The surface and edges of the foil are treated so that a thin coating, 5 to 10 μ in. thick, of aluminum oxide is formed on them. Heat removal from an experimental coil is considered. (W.D.M.)

22196 ORNL-2745(p.74-8)
Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering and Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
SYNTHESIS OF INHOMOGENEOUS MAGNETIC FIELDS. D. R. Whitehouse. p.74-8 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 5p.

A complete analytic expression for the magnetic field of current-carrying coils is difficult to obtain. However, research in plasma physics has created a need for synthesizing specified inhomogeneous, magnetic fields with such coils. Several people at M.I.T. who have been associated with the Microwave Gas Discharge Group have done work on the design of electromagnets to produce a magnetic mirror field configuration. Both the theory and the experiments that have been completed are summarized. (auth)

22197 ORNL-2745(p.79-86)
Los Alamos Scientific Lab., N. Mex.
MAGNETIC FIELD PROBLEMS ASSOCIATED WITH THE LOS ALAMOS THERMONUCLEAR EXPERIMENTS. F. L. Ribe. p.79-86 [of] PROCEEDINGS OF SYMPOSIUM ON MAGNETIC FIELD DESIGN IN THERMONUCLEAR RESEARCH HELD AT GATLINBURG, TENNESSEE, DECEMBER 11 AND 12, 1958. 8p.

A brief summary is given of some of the magnetic

field problems which have been encountered in connection with the Los Alamos experiments. It may generally be remarked that to date, nearly all of the field coils are pulsed, air cooled, and capacitor driven. Large d-c coils have not been much used, except in the case of a large 250-kw solenoid designed for plasma diffusion experiments. Some of the Los Alamos experiments are identified and bits of related magnetic field experience noted. (auth)

22198 ORNL-2803
Oak Ridge National Lab., Tenn.
COHERENT RADIATION FROM A PLASMA. E. G. Harris and A. Simon. Oct. 7, 1959. 11p. Contract W-7405-eng-26. $0.50(OTS).

The so-called "Collisionless Boltzmann Equation" or "Vlasov Equation" has been derived previously by Harris by use of a complete statistical treatment of both the plasma particles and the electromagnetic fields. It is shown that a consequence of this approximation is that the entropy of the electromagnetic field as well as that of the plasma particles is a constant. This result is used to demonstrate that only completely coherent radiation may be emitted by a plasma obeying the Vlasov equation. (auth)

22199 UCRL-5195(Rev.)
California. Univ., Livermore. Lawrence Radiation Lab.
BOUNDARY-LAYER FORMATION IN THE PINCH. John Killeen, Gordon Gibson, and S. A. Colgate. Aug. 10, 1959. 40p. Contract W-7405-eng-48. $6.30 (ph), $3.00(mf) OTS.

A study is made of various processes that occur prior to the pinch effect when an electric field is applied to deuterium gas. The variables of the problem are the percentage of ionization, the electron and ion temperatures, the resistivity of the gas, and the current density. A one-dimensional problem is considered in which the above variables are determined as functions of one space dimension and the time. The equations determining these variables are: the heat developed as the current flows through the gas equals the rate of increase of the internal energy of the plasma, the equation describing the rate of ionization, the equation describing the rate of transfer of energy from electrons to ions and the electromagnetic field equations. These equations are a generalization of the plasma equations solved in the paper of Wyld and Watson in that spatial dependence is included, i.e., a current layer is calculated instead of assuming a constant current. The equations are solved numerically using an IBM 704 computer. (auth)

22200 UCRL-5653
California. Univ., Livermore. Lawrence Radiation Lab.
APPLICATION OF A MODIFIED DEBYE-HÜCKEL THEORY TO FULLY IONIZED GASES. R. E. Kidder and H. E. DeWitt. Aug. 14, 1959. 16p. Contract W-7405-eng-48. $3.30(ph), $2.40(mf) OTS.

The equations of the Debye-Hückel theory, modified to include quantum statistics, are discussed. It is found that the nonlinear equations used by Cowan and Kirkwood are not unique and that the nonlinear theory can be formulated in different ways to give different answers. The linearized equations of these alternative formulations are discussed, and the correct form of the linearized theory is established. From the linear theory, the Helmholtz free energy of a slightly degenerate plasma is derived, and from this result, useful formulas in the near-classical limit are obtained for the pressure and internal energy. (auth)

22201
HYDROMAGNETIC THEORY OF PLASMA. Heinz Kautzleben. Abhandl. Geomagnet. Inst. Potsdam No. 20, 7-87(1958). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 8713).

A survey of hydromagnetic theory of plasma is presented. Included are sections on macroscopic examination, relativistic principles of magnetohydrodynamics, magnetohydrodynamic media, fundamental equations of magnetohydrodynamics, linearization of the principal equations, incompressible magnetohydrodynamic medium, problems in plasma dynamics, transition to magnetohydrodynamics, and the magneto-ionic method.

22202
THE POSSIBLITY OF FORMATION OF A PLASMA BY INJECTION OF ACCELERATED IONS INTO A MAGNETIC MIRROR CONFIGURATION. Francois Prévot, Pierre Hubert, and Christian Gourdon (Commissariat à l'Énergie Atomique, [Paris]). Compt. rend. 249, 997-9(1959) Sept. 14. (In French)

A proposal is made to form a high-temperature plasma by injection of fast molecular ions in a magnetic field in such a way that the injected ions from an annular source pass through the axis of revolution of the system and are dissociated. The properties of this movement give hopes of advantageous performance from this mode of injection. A numerical example is given. (tr-auth)

22203
OHMIC HEATING CIRCUITS FOR PLASMA PHYSICS. Rodger L. Gamblin (Princeton Univ., N. J.). Electronics 32, No. 41, 57-9(1959) Oct. 9.

Hydrogen gas is confined in the stellarator by a twisted magnetic field of 20,000 gauss or greater. An r-f generator ionizes the gas, then an audio signal completes ionization and raises the resulting plasma to one million degrees C. The experimental system produces 1.2 megavolt-amperes at 0 to 20 Kc. (C.J.G.)

22204
PLASMA JET PIERCING OF MAGNETIC FIELDS AND ENTROPY TRAPPING INTO A CONSERVATIVE SYSTEM. James L. Tuck (Los Alamos Scientific Lab., New Mex.). Phys Rev. Letters 3, 313-15(1959) Oct. 1.

To obtain a thermonuclear plasma inside a magnetic confinement system, one must either (a) create the plasma in situ from cold gas by ionization and heating or (b) build up the plasma piecemeal by injection from some accelerator or hydromagnetic gun. A new method is proposed of achieving the nonadiabatic process of type (b) which may prove very advantageous. (W.D.M.)

22205
ION TEMPERATURE IN SCYLLA, AS DETERMINED FROM THE REACTION D(d,p)T. D. E. Nagle, W. E. Quinn, W. B. Riesenfeld, and W. Leland (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. Letters 3, 318-20(1959) Oct. 1.

An experiment is described which was designed to measure directly the ion temperature in Scylla. By studying the velocity spectrum of products of the reaction D(d,p)T, the mean square velocity of the d-d system center-of-mass was measured, and the plasma temperature was inferred. A temperature of T = 1.3 kev was determined. (W.D.M.)

CRITICALITY STUDIES

22206 AHSB-17

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

CRITICAL ASSEMBLIES OF INFINITE SLABS OF HIGHLY ENRICHED URANIUM AND WATER. E. R. Woodcock. June 30, 1959. 31p.

Criticality factors of single and interacting infinite slabs of highly enriched uranium separated and reflected by water or by mixtures of uranium and water were studied. A number of critical assemblies were calculated including, in particular, the changes in criticality as the uranium slabs dissolve into the surrounding water. Minimum critical loadings of uranium as a function of core slab thickness were estimated for systems in which heterogeneities occur only across the plane of the slab. The effect of heterogeneities in the plane of the slab is discussed and it is concluded that these can, in certain circumstances, increase the criticality of the system. (auth)

22207 AI-4120

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

EPITHERMAL CRITICAL EXPERIMENTS; PRELIMINARY SAFEGUARDS REPORT. ADVANCED EPITHERMAL THORIUM REACTOR PROGRAM. D. T. Eggen and H. A. Morewitz. Aug. 12, 1959. 160p. Contract SAEA-1. $4.80(ph), $2.70(mf) OTS.

To facilitate hazards evaluation of the Epithermal Critical Experiment Laboratory, descriptions of the assembly, the laboratory and its environs are presented. The safeguards which were included in the design and plans of operation are discussed. Various parameters of the reactor core such as the critical mass, control rod worths, table separation, reactivity loss caused by excursion fuses, and inherent shutdown reactivity were calculated for a representative loading of the assembly. The critical assembly will contain U^{233} in the test region at the center of the core. This material presents both an alpha ingestion and an external beta-gamma hazard. Special precautions were taken in the design of the assembly and the laboratory in order to reduce the possibility of releasing this material during an accident and to contain and shield it under normal operating conditions. Attention was given to the possible accidents which might occur in the operation of the critical experiments. The precautions to be taken to avoid these accidents are described. The consequences of transients following the inadvertent insertion in the reactor of various amounts of excess reactivity are considered. All phases of the operating procedures and the parameters and design of the reactor and laboratory were investigated to determine any possible failure which might lead to an accident. Analysis of the maximum confinable accident amounting to an excess step reactivity input of 3% $\Delta k/k$ leads to vaporization of part of the driver (U^{235}) fuel if none of the safety devices are operative. Other amounts of excess reactivity insertion are studied as well as cases where protective action is taken. A 3% $\Delta k/k$ step input of reactivity without any protective system leads to an energy burst of less than 150 Mw, most of which is expended in heating the driver fuel pieces (80% aluminum). About 20 to 30 Mw is utilized in vaporization and expansion of the driver; the building is designed to confine such an accident. The radiation dose received by the operating personnel from the maximum confinable excursion would be 3 rem in the control or subassembly room. If the building integrity were lost during or following this accident and the radioactivity were released, the radiation downwind from the laboratory at the location of the nearest residences, about 2 miles from the laboratory, would be less than 50 mrem under the worst atmospheric conditions. Thus, such an accident would not result in a severe radiation hazard to the environs of the reactor. The possibility of driver fuel-plate vaporization in any accident less than that caused by a 3% $\Delta k/k$ step input of excess reactivity was guarded against in the design of the excursion fuses and the critical assembly room. (auth)

22208 CF-59-9-3

Oak Ridge National Lab., Tenn.

EUROCHEMIC ASSISTANCE: ANSWERS TO QUESTIONS ON CRITICALITY. E. D. Clayton. Sept. 11, 1959. 4p. $1.80(ph), $1.80(mf) OTS.

Answers to questions on the criticality of Pu and Pu solutions are presented. (W.L.H.)

22209 HW-61547

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

CRITICALITY OF FUELS OF LOW ENRICHMENT IN CYLINDERS. N. Ketzlach. Aug. 14, 1959. 12p. $3.30(ph), $2.40(mf) OTS.

Curves are presented of critical masses as a function of cylinder diameter and fuel rod size for 1.6, 3.0, and 5.0% U^{235} enriched metal-water systems. (W.D.M.)

22210 NAA-SR-Memo-3659

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

NUCLEAR CALCULATIONS FOR THE ORGANIC MODERATED EXPONENTIAL EXPERIMENTS. J. J. McClure. Mar. 23, 1959. 8p. $1.80(ph), $1.80(mf) OTS.

Two group diffusion theory was used to obtain the critical loading, the thermal utilization, and the radial fluxes for a 13-element loading of the 12-plate element and a 9-element loading of the 10- and 19-plate elements in the OMR exponential experiments. Results are compared with measured values. (W.D.M.)

22211 NAA-SR-Memo-3980

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

CRITICAL MASS OF AN OMR CORE USING PLATE TYPE FUEL ELEMENTS. H. C. Field. June 8, 1959. 4p. $1.80(ph), $1.80(mf) OTS.

The clean critical mass of an OMR core was determined experimentally using low enrichment U plate-type fuel elements in a six-inch lattice spacing and Santowax R at 340°F as the moderator. Criticality was attained with 39 fuel elements (3915 kg) present in the core, three shim rods withdrawn, and the fourth shim rod about $\frac{7}{8}$ withdrawn. (W.D.M.)

22212 UCRL-5369(Pt.1)

California. Univ., Livermore. Lawrence Radiation Lab.

CRITICAL MEASUREMENTS ON NEAR-HOMOGENEOUS BeO-MODERATED, ORALLOY-FUELED SYSTEMS. Fred A. Kloverstrom, Richard M. R. Deck, and Arnold J. Reyenga. July 1, 1959. 13p. Contract W-7405-eng-48. $0.50(OTS).

A series of critical measurements on unreflected systems, fueled by thin Oy foils, is described. Fuel density is varied by use of different foil thicknesses and spacings between foils. Five fuel densities were

used which correspond to atomic BeO/U^{235} ratios from 246 to 7660. For three of these ratios, the fuel foil thickness was varied to find effects of self-shielding and flux depression. (auth)

22213

CALCULATION ON THE DIMENSION CHANGE EFFECT ON THE FAST REACTOR CRITICAL MASS BY MEANS OF THE PERTURBATION THEORY. S. B. Shikhov. Atomnaya Energ. 6, 162-8(1959) Feb. (In Russian)

A method is suggested for calculating critical reactor mass with respect to active zone composition and dimensions. An operating formula is developed by the ordinary first approximation scheme in the theory of perturbations. In order to calculate the formula coefficients it is necessary first to find the neutron spatial-energy spectra for certain fixed active zones with sufficiently thick reflectors. The critical mass in a wide range of variations was predicted on the basis of the obtained formula coefficients. For cases when the dimensions of the active zone exceed the studied range, a numerical calculation of spectra becomes necessary for calculating coefficients. A formula is derived with coefficients estimated for typical fast reactors. The formula was corrected by nine-group numerical calculations for active zone volumes from 200 to 1000 ∂m^3. (tr-auth)

GEOLOGY AND MINERALOGY

22214 ORO-205

Tennessee. Univ., Knoxville.

THE CHATTANOOGA SHALE OF TENNESSEE AS A SOURCE OF URANIUM. Final Report. Paris B. Stockdale and Harry J. Klepser. July 1, 1959. 234p., 2 ills. Contract AT(40-1)-1337. $3.50(OTS).

The over-all aim of the study has been to obtain a thorough geologic picture of the Chattanooga shale, with emphasis upon stratigraphic relationships and associated special problems from which, in turn, implications may be obtained as to the origin and age of the formation and possibly the source of the U. The study has not been aimed primarily at exploration for U and its economic aspects. (auth)

22215 RME-1068

Division of Raw Materials. Denver Exploration Branch, AEC.

PRELIMINARY REPORT ON URANIUM DEPOSITS IN THE GULF COASTAL PLAIN, SOUTHERN TEXAS. S. R. Steinhauser and E. P. Beroni. Including a section on: RADIOMETRIC AIRBORNE SURVEY OF PARTS OF KARNES, ATASCOSA, AND LIVE OAK COUNTIES, TEXAS. Robert G. Blair. Nov. 1955. 43p. $1.25 (OTS).

Concentrations of secondary uranium minerals, some of which are commercially significant, were found in three formations of Tertiary age in the Gulf Coastal Plain area of southern Texas: the Fayette sandstone of the Jackson formation, the Catahoula tuff, and the Oakville sandstone. The uranium minerals occur in tuffaceous sandstones and sandy shales of continental origin, outcropping in a narrow belt paralleling the Gulf Coast and extending from Gonzales County on the northeast to Duval County on the southwest—a strike length of approximately 150 miles. Uranium minerals identified include autunite, metaautunite, carnotite, uranophane, schoepite, and a uraniferous opaline material. The mineral assemblage varies considerably among different deposits and may include, locally, molybdenum minerals and an unidentified arsenic mineral. The best single tool for prospecting in this area is the scintillation counter-equipped light plane, although geochemical and geobotanical prospecting and the combined use of air and ground radiometric surveying may prove to be more effective in outlining ore deposits in areas of heavy cover. (auth)

22216 TEI-751

Geological Survey, Washington, D. C.

GEOLOGIC INVESTIGATIONS OF RADIOACTIVE DEPOSITS. Semiannual Progress Report [for] December 1, 1958 to May 31, 1959. June 1959. 133p. $2.75 (OTS).

A general study was made of systematic geologic mapping and research of the Lisbon Valley Area, Laguna district, Grants area, Southern Black Hills, and Colorado plateau. Geologic topical studies, geophysical and radioactivity investigations, and general research problems were included. (For preceding period see TEI-750). (J.E.D.)

22217

ON THE POSSIBLE PARTIAL SUBSTITUTION OF CALCIUM BY URANIUM IN THE LATTICE OF APATITE. G. Carobbi and F. Mazzi (Comitato Nazionale per le Ricerche Nucleari, Milan). Atti accad. naz. Lincei. Mem. Classe sci. fis. mat. e nat. Sez. IIa 5, No. 6, 159-71(1959).

The possible isomorphous substitution of calcium by uranium in the apatite lattice was investigated. Apatite, prepared by crystallization from a melted solvent with both tetravalent and hexavalent uranium present, contains no more than 0.05% uranium, which is present as submicroscopic inclusions. By suspending apatite in water solutions containing U^{4+} or $(UO_2)^{2+}$, uranium is precipitated by phosphoric ions passing into solution from the mineral, and the apatite crystal is covered with a patina of uranium phosphates. The possible substitution of calcium by uranium in the apatite lattice was not confirmed. (auth)

22018

ON THE FORMS OF THE OCCURRENCE OF URANIUM IN GRANITES. A. Ya. Krylov and L. Ya. Atrashenok. Geokhimiya 4, No. 3, 246-51(1959).

For the purpose of obtaining data concerning the form in which uranium occurs, samples of rocks and minerals were leached out for five days with a 0.2 N solution of Na_2CO_3. Five groups of metamorphosed granite from the Tyan'-Shan' were investigated. The results indicate the following: monazite, zirconium, sphene, fluorite, and orphite during leaching give off only a small part of their uranium; quartz and feldspar give off a larger part of their uranium content only if uraninite also occurs in the rock; and the largest quantity of uranium is leached out of magnetite. A second leaching in all cases resulted in considerably lower values. In conclusion it may be said that uranium occurs in granites as an oxide, a secondary mineral, or as an adsorbed compound. (TCO)

22019

INVESTIGATION OF THE ACTINIUM-RADIUM RATIO IN MINERALS. V. V. Cherdyntsev, L. I. Shmonin, N. S. Strashnikov, and O. L. Asanova. Byull. Komissii Opredelen. Absolyut. Vozrasta Geol. Formatsiĭ, Akad. Nauk S.S.S.R., Otdel. Geol. Geograf. Nauk, No. 2, 41-65

(1957). (Translated from Referat. Zhur. Geol. No. 10, 1957, p.133).

The ratios of activity between the uranium and the actinium series were determined in a large number of minerals. Data were also obtained on the ability of some products of the actinium series to migrate under natural conditions. In the tests for Ac/Ra in primary minerals—various oxides, aluminum silicates, titanates, zirconates, niobate-tantalates, phosphates, tungstates, and asphaltites—it was shown that the ratios are normal. In secondary minerals, Ac/Ra may deviate markedly from the normal. This deviation is explained by the complex processes of migration. In many secondary minerals in the zone of oxidation, Ac/Ra is controlled by the migration of Ac and Ra. In some cases this relationship may occur only if the decay products of U migrate. Spring deposits show a very large fluctuation of Ac/Ra (0.03-17). In some primary minerals the age of the minerals is known to be older than needed to establish equilibrium in the uranium series and between uranium and actinium. Such minerals are said to be anomalous. The majority of the anomalous minerals studied are only weakly active, their content of radioactive elements being below the average for the earth's crust. An anomalously high Ac/Ra occurs in many primary minerals, chiefly of hydrothermal origin. The largest anomalies ratio is found in minerals which, to the eye, are well preserved, and it is also found in many minerals that are stable in the zone of oxidation. Secondary alteration of minerals in the zone of oxidation does not produce an increase but more commonly a decrease in the anomalous value. The anomaly coefficient, on the average, increases in weakly active mineral varieties. The cause is anomalies in primary minerals is essentially different from the increase in Ac/Ra that occurs in young secondary minerals. These anomalies are explained both by the more rapid accumulation of Ac than Ra in young uranium minerals and by the ability of Ra to migrate. Anomalous minerals encountered in geochemical associations do not display enrichment in the radioactive elements. It is shown that it is possible to determine the age of young minerals by the ratio of Ac to Ra. (TCO)

22220

A BERYLLIUM DETECTOR FOR FIELD EXPLORATION. George M. Brownell (Univ. of Manitoba, Winnipeg, Can.). Econ. Geol. 54, 1103-14(1959) Sept.-Oct.

The portable instrument, here referred to as a "berylometer," is a new geophysical tool for the use of the geologist in both exploration and examination of beryllium deposits. This is a scintillation counter which contains a phosphor having a high neutron to gamma ratio of detection and makes use of the $Be^{9}(\gamma,n)Be^{8}$ reaction. A gamma emitting source is carried in a shield on the bottom of the instrument which, when set upon any beryllium-bearing mineral or rock, causes the emission of neutrons from the beryllium which are immediately recognizable. Gamma rays are biased out and neutrons only are counted. An automatic counting register records the neutron count and since this is directly proportional to the beryllium content of a sample, a simple means of analysis is provided. The use of beryllium would expand rapidly if adequate reserves could be established and also if, with increased production, a lower cost could be attained. The discovery of non-pegmatitic deposits offers a better prospect for the development of substantial reserves in contrast to the generally small size of beryllium-bearing zones as found in pegmatites. Towards this end the Berylometer provides a much-needed field instrument for all persons engaged in the search for beryllium ore. (auth)

22221

URANIUM AND THORIUM WORLD RESOURCES. Felice Ippolito (Comitato Nazionale per le Ricerche Nucleari, Milan). Ind. mineraria (Rome) 10, 87-8(1959) Feb.

On the basis of data presented at the Second Geneva Congress, estimations on uranium resources, production, needs, and cost are given. Thorium resources are also briefly considered. (auth)

22222

THE ABSORPTION OF GAMMA RAYS BY SEDIMENTARY ROCKS. L. S. Polak and M. B. Rapoport. Priklad. Geofiz. Sbornik Statei No. 15, 135-9(1956). (Translated from Referat. Zhur. Geol. No. 10, 1957, p.209).

The relationship of gamma absorption coefficient to rock density was proved experimentally. A source of gamma rays consisting of rock with a thickness $x \geq 3$ cm and an AMM-12 counter were placed in a lead chamber with walls 5 cm thick. The distance from the source to the sample was sufficiently great, in comparison to the dimension of the latter, to allow the gamma rays passing through the sample to be considered parallel. The counter rested against the sample on the side opposite the source, and was fully shielded by the sample from direct radiation. The pulse count was obtained. The absorption coefficient was computed from the formula: $\mu = x^{-1} \ln I_0 I^{-1}$, where I and I_0 are the count rates with the sample present and absent respectively. From the data obtained in measuring samples of clay, sandstone, anhydrite, limestone, and dolomite, it was determined that $\mu \simeq 0.5\rho$, where ρ is rock density. This led to the conclusion that gamma absorption for sedimentary rocks depends on the Compton effect, while the influence of the photoelectric effect and the formation of electron-positron intervals are negligible. The fact that μ changes only with ρ, and also the lack of influence exercised by the mineral composition of rocks, make gamma-gamma logging possible. In interpreting gamma-log curves, it should be taken into consideration that the change in the intensity of gamma radiation should be more abrupt at the contact of the radioactive stratum with a zone of large density, while the change should be more gradual at the contact with a stratum of a lesser density. For this reason, the anomalies shown by gamma-log curves may exhibit asymmetric shapes. (TCO)

22223

GRID-MODEL CONSTRUCTION FOR NEUTRON GAMMA LOG. A. Ye. Kulinkovich. Priklad. Geofiz. Sbornik Statei No. 15, 180-4(1956). (Translated from Referat. Zhur. Geol. No. 10, 1957, p.208-9).

The application of a grid-model technique for the solution of problems in neutron gamma logging is proposed. The model must be of the same kind as that used in solving the problems of resistivity logging with some changes introduced. Instead of the source of current placed on the axis of the drill hole, sources are introduced into the centers of the cells. To this end, the nodes of the grid are connected through resistors to the source of current. In this way the spatial distribution of the sources of high-velocity neutrons is represented. A resistor is attached to each node of the

grid, and each resistor is then grounded. The force of current passing a resistor should correspond to the quantity of neutrons absorbed by the volume element of the medium, represented by the cell of the grid. A relationship was determined between the equation expressing Kirchoff's first law—for a node of any grid cell—and the differential equation for the distribution of high-velocity neutrons, in the case when the diffusion coefficient for the entire medium is constant. It is shown that in order to depict the excitation of a uniform medium in any particular zone of space, one must similarly change the resistivities of the grid cells associated with this zone of space. It is proposed that, in order to determine the intensity of gamma radiation at the point of observation, the total $I = \Sigma a_i n_i$, where n_i is the neutron density obtained in the model for the point of space corresponding to the i-node of the grid; a_i is a factor determined by calculations. (TCO)

22224

DISCOVERY OF THE RARE ELEMENT MINERALS IN POST-CAMBRIAN GRANITE PEGMATITE. Tung-hung Mang. Ti Chih Lun P'ing 18, 317-19(1958). (From Sci. Abstr. China; Earth Sci. No. 2, 1958, Abstract No. 58.)

Rare element minerals Nb, Ta, monazite, etc. was found in post-cambrian pegmatite. Minerals identified are columbite and monazite, possible containing uraniobite and germanium-manganese garnet. Most of the minerals are produced dispersedly in the zone of massive feldspar quartz in the pegmatite. (W.D.M.)

22225

THE INFLUENCE OF THE SIZE OF PROBE ON THE RESULTS OF MEASUREMENTS BY THE NEUTRON GAMMA METHOD. A. I. Kholin, S. A. Kanton, V. V. Larionov, and O. A. Barsukov. Trudy Moskov. Neft. Inst. im. I. M. Gubkiva, No. 13, 236-46(1955). (Translated from Referat. Zhur. Geol. No. 1, 1957, p.157).

In association with the ultimate size of a probe for gamma radiation during radiometric investigation of drill holes, the intensity of secondary gamma radiation I_{rec} is distinguished from the theoretical $I_{0\ rec}$, calculated on the assumption that the indicator is accurate, in the relation $I_{rec} = I_{0\ rec} \frac{2}{\mu a} sh(\mu a/2)$, where μ is a coefficient depending on the hydrogen content of the medium, a is the length of the probe, and sh is the hyperbolic sine. To determine quantitatively the porosity by intensity of secondary gamma radiation, it is expedient to use a probe of minimum length or to introduce a correction to the value of the recorded intensity for the length of the probe. Curves are supplied to show the relationship between the correction factor and the value of μa produced. The ultimate length of the probe leads to a distorted actual length of the sonde ($l_{act.}$) by the neutron gamma method, calculated from the computation of l between the source and the middle of the indicator. To obtain an approximate calculation of the actual length of the sonde, the formula $l_{act.} = pq/q-p \log q/p$, is recommended where p and q are the distances from the source of neutrons to the first and second ends of the counter. (TCO)

22226

OCCURRENCE OF NONPEGMATITE BERYLLIUM IN THE UNITED STATES. Lawrence A. Warner, William T. Holser, Verl R. Wilmarth, and Eugene N. Cameron. U. S. Geol. Survey. Profess. Papers. No. 318, 1959. 206p., 4 illus. $2.25(GPO).

During the period 1948 to 1950 the U. S. Geological Survey conducted a program of field, laboratory, and library research to determine the occurrence and distribution of beryllium in nonpegmatite rocks and mineral deposits and to appraise the extent to which these might furnish beryllium ore. Although no deposits of present commercial value were found, the investigation has set criteria that will be of value in future prospecting. The average beryllia content of the lithosphere is about 0.001%. Beryllium is thus more abundant than certain other metals, such as arsenic, gold, silver, tungsten, and molybdenum. Unlike these elements, however, beryllium does not readily form sulfides and oxygen salts, which constitute the bulk of metalliferous ores. Because of its small ionic radius, resulting low coordination number, and strongly electropositive character, crystal structures that will permit high concentrations of beryllium in minerals are comparatively rare. It forms only a few stable minerals of its own, such as beryl, helvite, chrysoberyl, and phenakite. In other silicates, including the common rock minerals, it may replace elements such as silicon and aluminum to a slight extent. Under special conditions, as when it fills normally empty lattice positions in idocrase, it may be present in appreciable quantity. As an accessory constituent in rock minerals, beryllium is somewhat more common in granitic and feldspathoidal rocks than in other igneous rocks. Its principal occurrence is in beryl in granitic pegmatites. Other than in pegmatites, beryllium minerals are found chiefly in quartz-tungsten veins and prometasomatic deposits. Small amounts also occur in other types of veins, particularly quartz-gold and manganese veins. In most of these occurrences beryllium is found with fluorite; in pyrometasomatic deposits it sometimes occurs with fluorine-rich beryllian idocrase. Many sedimentary rocks contain small quantities of beryllium, particularly those formed by residual concentration, as the metal hydrolyzes in a manner similar to aluminum. For the most part, however, beryllium tends to be dissipated by processes of weathering and sedimentation. Under simple metamorphic conditions, beryllium is not easily mobilized, and therefore it is not concentrated in metamorphic rocks other than pyrometasomatic deposits. Pyrometasomatic deposits and feldspathoidal rocks were sampled at many localities in the United States. Only a small proportion of the pyrometasomatic deposits contained detectable quantities of beryllium; the richest are the deposits at Iron Mountain, N. Mex. In the feldspathoidal rocks beryllium was found only as an accessory constituent in rock minerals. Some of the vein deposits investigated have promise as possible sources, but sampling was not sufficiently detailed to furnish a basis for calculating reserves. In places the beryllium content compares favorably with that of beryl pegmatites. Mining of these deposits will depend on an increase in price of beryllium, improved beneficiation methods, and utilization of coproducts and byproducts. (auth)

22227

NEW INSTRUMENTS AND METHODS OF ENGINEERING GEOLOGY. N. V. Glazov and A. N. Glazov. Translated from Russian by J. Paul Fitzsimmons. New York, Consultants Bureau, Inc., 1959. 91p.

The volume consists of five chapters which include: New Methods for Studying Deflation, Erosion, and Transport of Material; The Use of Radioactive Isotopes in Studying Solubility and Leaching in Saline Soils; New

Instruments and Methods Utilized in Engineering Geological Investigations; New Methods in Drilling and Hydrogeological Work; A New Type of Water Intake and Its Approximate Calculation. (W.L.H.)

22228

A METHOD OF BORE HOLE RADIOMETRY. V. P. Ivankin. U.S.S.R. Patent 113856. Byull. Izobret., 1958, No. 6.

A method consisting of irradiation of the rocks with a stream of neutrons and recording the secondary gamma-radiation is discussed. Only the soft part of the secondary radiation is recorded for obtaining data on the density of rock. (TCO)

HEALTH AND SAFETY

22229 AFCRC-TN-58-652

Air Force Cambridge Research Center. Geophysics Research Directorate, Mass.

NATURAL AEROSOLS AND NUCLEAR DEBRIS STUDIES. Progress Report No. I. GRD Research Notes No. 8. P. J. Drevinsky, C. E. Junge, I. H. Blifford, Jr., M. I. Kalkstein, and E. A. Martell. Sept. 1958. 49p. Project No. 7690. Contract AT(49-7)-1431. (AD-209539). $7.80(ph), $3.30(mf) OTS.

A program of research on radioactive and inactive aerosols in the atmosphere is described. Preliminary results on the size distribution of particulate aerosols of the troposphere and stratosphere are presented. Results of measurements of Sr^{90} in polar snow cores and Sr^{90}, Ba^{140}, and other fission products in precipitation and in stratospheric air are presented. (auth)

22230 HASL-69

New York Operations Office. Health and Safety Lab., AEC.

STRONTIUM PROGRAM QUARTERLY SUMMARY REPORT. Edward P. Hardy, Jr. and Stanley Klein. Oct. 1, 1959. 208p. $3.50(OTS).

Data on the Sr program accrued since HASL-65 are presented. Levels of Sr^{90} in fallout, air, water, milk, vegetation, foods, animal and human bone are given, based on data available from May 21 to September 1, 1959. In addition, the effect of milling on Sr^{90} levels in wheat are shown in a material balance study. An included bibliography of recent literature lists material related to fallout and the Sr program. An appendix is included which comprises cesium and potassium measurements on humans and milk. (auth)

22231 KAPL-A-HP-4

Knolls Atomic Power Lab., Schenectady, N. Y.

OPERATING MANUAL; RADIOLOGICAL STANDARDS AND MEASUREMENTS. G. W. Gasper. Oct. 1, 1958. 62p. Contract W-31-109-Eng-52. $12.30(ph), $4.50 (mf) OTS.

This manual contains the procedures for distribution, recall, calibration, and maintenance of personnel monitoring devices; the techniques of determining radiation exposure and maintaining continuous and permanent records; and the procedures for notification in the event of significant exposure. (auth)

22232 NYO-2841

Columbia Univ., Palisades, N. Y. Lamont Geological Observatory.

DISTRIBUTION OF NUCLEAR FALLOUT. Annual Report [for] period October 1, 1958–September 30, 1959. Oct. 1, 1959. 170p. Contract AT(30-1)-1656. $27.30(ph), $8.10(mf) OTS.

Data are tabulated from a world-wide study on the movement of radioactive isotopes produced in nuclear explosions from the atmosphere through the biosphere to man. Studies involving bone, milk, and food analyses were directed to yield information on the manner in which fission products are absorbed by man. The human bone program has permitted definition of the average levels in man over the earth. Intraskeletal distribution was examined and the relation of levels in the adult mother, the fetus, and the child were defined. A comprehensive study was made of milk from domestic and international sources. Mechanisms of the movement of radioactive strontium and cesium from the atmosphere to plants to man were studied. A survey was made on levels of radioactivity in foods from Central and South America and Africa. Geochemical studies were made on the amount of fall-out in rain, the vertical penetration in the soil, the validity of various sampling methods, activity levels as a function of time, and the relation of rate and cumulative factors in determining levels in foods. Measurements on the carbon-14 concentration in man, food, and the atmosphere-hydrosphere system showed a gradual buildup of this isotope as a result of nuclear testing. The rate of movement through the biosphere to man, and the rate of movement between Northern and Southern tropospheres were estimated. Reprints and publications resulting from the studies are appended. (C.H.)

22233 OTO-58-6

Nevada Test Organization. Off-Site Radiological Safety Activities, AEC.

OPERATION HARDTACK—PHASE II OFF-SITE RADIOLOGICAL SAFETY REPORT, NEVADA TEST SITE, 1958. O. R. Placak, M. S. Seal, J. R. McBride, R. A. Gilmore, R. L. Elder, and J. S. Silhanek. 238p. Contract AT(29-2)-162. $3.50(OTS).

The off-site radiation monitoring program during Phase II of Operation Hardtack is described. Equipment and personnel were located in such a manner as to ensure maximum effectiveness in the collection of physical data pertaining to surface levels of activity, concentration of airborne activity, external gamma dose received by persons and places as determined by the use of film badges, and the beta activity contained in milk and water samples collected at a number of stations. Data are tabulated. (C.H.)

22234 USNRDL-TR-355

Naval Radiological Defense Lab., San Francisco.

THE CONDENSATION OF RUBIDIUM VAPOR ONTO HOT OXIDE SURFACES. C. E. Adams. Aug. 7, 1959. 33p.

By use of an atomic beam technique, an investigation was made of the condensability of vaporized rubidium in a slightly oxidizing atmosphere upon the surfaces of different oxides at varying temperatures. It was found that rubidium vapor was effectively condensed at high temperatures upon oxides with which rubidium oxide could form thermally stable complex compounds. Rubidium vapor was not condensed at high temperatures upon oxides with which rubidium oxide does not form stable complex compounds. A method of predicting the relative tendency for rubidium oxide to form complexes with a series of different oxides was devised. (auth)

22235 WT-26

Naval Radiological Defense Lab., San Francisco.

INTERPRETATION OF SURVEY-METER DATA.

E. Tochilin and P. Howland. ANNEX 6.5 OF SCIENTIFIC DIRECTOR'S REPORT OF ATOMIC WEAPON TESTS AT ENIWETOK, 1951. OPERATION GREENHOUSE. Aug. 1951. Decl. Mar. 6, 1957. 134p. $18.30(ph), $6.00(mf) OTS.

Under laboratory conditions a study of survey-instrument response to fission-product activity was made. Fission-product activity was collected on aluminum plaques which were flown through the radioactive cloud following each of four bursts. The response of various types of commercially available G-M counters and ion-chamber counters to fission-product beta-ray and gamma-ray fields was studied. Gamma-ray energies were determined by half-value-layer absorption measurements using narrow-beam geometry. In addition to the laboratory measurements, field determinations of residual gamma-ray energy were made in the vicinity of ground zero following Dog and Easy Shots. Changes in beta-ray energy were studied for the period from 44.6 to 215.7 hr. It was found that the beta-ray absorption curve could be reproduced by a high-energy and low-energy component of beta radiation. For early times the two components were 1.54 and 0.5 Mev, respectively, and approached a relatively constant value of about 1.41 and 0.5 Mev after 4 days. The ratio of beta dose to gamma dose on the surface of the plaques was measured for Dog and Item Shots and was found to be 156 and 157, respectively. Laboratory determination of effective gamma-ray energies using half-value-layer measurements by means of aluminum, copper, and lead filters showed the energy to be dependent upon the absorber used. (auth)

22236 WT-345

Naval Radiological Defense Lab., San Francisco.

BETA-RAY AND GAMMA-RAY ENERGY OF RESIDUAL CONTAMINATION. E. Tochilin, P. R. Howland, S. H. Fitch, R. Golden, and J. T. Barrett. Apr. 1952. Decl. June 15, 1958. 94p. Project 2.4a [of] OPERATION JANGLE. $15.30(ph), $5.40(mf) OTS.

By means of depth-dose measurements, obtained using photographic film packets, a study was made of the beta-ray energy and the ratio of beta- to gamma-ray ionization resulting from residual contamination following the surface and underground shots of Operation JANGLE. Measurements were also made of the residual gamma-ray energy. Readings of gamma-ray energy which were made with a group of modified ionization chambers and survey instruments calibrated to effective x-ray energies over a range from 65 to 1,200 kev, indicated the energies to vary between 84 and 140 kev for the surface shot and between 113 and 144 kev for the underground shot. To determine the effective energy of prompt gamma radiation plus base surge radiation, chambers were placed in the field prior to each shot and exposed to all radiations from time zero to approximately H + 3 hr. These measurements showed the energy to range between 430 and 565 kev for the surface shot and between 376 and 430 kev for the underground shot. Using photographic film packets the equivalent maximum beta energy measured in close proximity to the early-time fall-out contamination for the surface shot was no greater than 1.7 Mev. This energy was an average over a period of 24 hr following the surface shot. Additional measurements of this energy at 18 in. above the contaminated ground surface gave a value of 2.0 Mev. Equivalent maximum beta-energy measurements in close proximity to the early-time fall-out contamination for the underground shot gave a value no greater than 2.0 Mev when averaged over a period of 70 hr following the shot. Measurements at 18 in. above the contamination gave a value of 1.7 Mev. The maximum ratio of beta-to-gamma ionization measured with film packets located in highly contaminated areas was 14 for the surface shot and 24 for the underground shot. (auth)

22237 WT-397

Naval Radiological Defense Lab., San Francisco.

NATURE AND DISTRIBUTION OF RESIDUAL CONTAMINATION II. N. E. Ballou and L. R. Bunney. June 30, 1952. Decl. July 11, 1958. 65p. Project 2.6c-2 of OPERATION JANGLE. $10.80(ph), $3.90 (mf) OTS.

The importance of neutron induced radionuclides has been investigated in several samples from Operation JANGLE. Np^{239}, which is produced from the bomb materials, is the only neutron induced activity of major importance. The extent of fractionation of fission products at Operation JANGLE was shown to be quite great. Gross decay and energy measurements were carried out on a number of samples from Operation JANGLE. These measurements included a few samples as soon as six hours after detonation. Leaching was shown to have doubtful value as a method of soil reclamation after an underground burst under the conditions of this test. (auth)

22238 WT-423

Bureau of Plant Industry, Soils, and Agricultural Engineering.

PETROGRAPHIC STUDIES OF FALLOUT MATERIAL FROM THE SURFACE AND UNDERGROUND SHOTS. Irvin C. Brown and Lyle T. Alexander. May 1953. Decl. Dec. 13, 1954. 73p. Project 2.8 Supplementary Report [of] OPERATION JANGLE. $10.80(ph), $3.90 (mf) OTS.

Representative glassy and unfused particles from the Jangle atomic bomb explosions have been photographed. Petrographic examination of the minerals remaining have been identified. All degrees of fusion have occurred. The minerals in the glassy particles make up only a small part of the whole. Of those determined about 35 per cent are quartz and about 45 per cent are feldspar. (auth)

22239 WT-746

Army Medical Service Graduate School, Washington, D. C.

BETA-GAMMA SKIN HAZARD IN THE POSTSHOT CONTAMINATED AREA. James T. Brennan. Dec. 1953. Decl. Mar. 6, 1957. 34p. Project 4.7 of OPERATION UPSHOT-KNOTHOLE. $6.30(ph), $3.00(mf) OTS.

Theoretical calculations for certain idealized geometries have indicated that in a bomb contaminated area the beta radiation dose-rate should far exceed the gamma dose-rate at all points less than 2 meters above the ground level. This conclusion poses an awkard radiological safety problem because existing personnel monitoring devices measure gamma dose only and maximum permissible doses, and radiation hazard control policies in general, in field efforts, are based solely upon the measurement of gamma dose. In the present experiment the beta and gamma radiation dose that would be received by the sensitive layer of the skin was measured in several contaminated areas in Frenchman Flat and Yucca Flat. Specially constructed, thin-walled ion chambers were used which were sensi-

tive to gamma rays and to all beta particles considered to be a hazard. It was found that, although there is, indeed, an increase in radiation hazard at points near the ground, the very large beta dose to be expected from theory does not actually occur in the field. Because of the particulate nature of the contamination the conclusions reached do not apply for elevations of less than 1 cm. (auth)

22240 WT-817
Armed Forces Special Weapons Project. Field Command, Albuquerque, N. Mex.
RADIOLOGICAL SAFETY OPERATION, MARCH–JUNE 1953. Tom D. Collison. June 1953. Decl. Sept. 9, 1958. 172p. Operation UPSHOT-KNOTHOLE. $25.80(ph), $7.80(mf) OTS.

Radiological safety procedures for the test shots in the Upshot-Knothole series are described. Fallout measurements in the Nevada Proving Grounds and its environs are tabulated and discussed. The history and the organization of the Rad-Safe Unit are outlined. (C.W.H.)

22241 WT-1015
Scripps Institution of Oceanography, La Jolla, Calif.
MECHANISM AND EXTENT OF THE DISPERSION OF FISSION PRODUCTS BY OCEANOGRAPHIC PROCESSES AND LOCATING AND MEASURING SURFACE AND UNDERWATER RADIOACTIVE CONTAMINATION. Theodore R. Folsom. July 1956. Decl. Oct. 23, 1958. 58p. Project 2.6 (Part II) of OPERATION WIGWAM. $7.80(ph), $3.30(mf) OTS.

The nature and extent of radioactively-contaminated ocean water resulting from the Wigwam test shots were investigated. The water mass was larger and less active and was located different than was anticipated. (C.W.H.)

22242 WT-1166(Del.)
Armed Forces Special Weapons Project. Field Command, Albuquerque, N. Mex.
RADIOLOGICAL SAFETY. Tom D. Collison. May 1955. 175p. Operation TEAPOT. $28.80(ph), $8.40 (mf) OTS.

The organization and function of the various sections of the Joint Test Organization On-Site Rad-Safe Group are given. These include: dosimetry and records section, plotting and briefing section, monitoring section, logistics, and decontamination section. Data recorded by these groups during Teapot Operation are given. (T.R.H.)

22243 WT-1685
Los Alamos Scientific Lab., N. Mex.
RADIOLOGICAL SAFETY. Gordon L. Jacks and George C. Zimmerman. Nov. 15, 1958. 48p. OPERATION HARDTACK. $7.80(ph), $3.80(mf) OTS.

A description is given of the mission, organization, and activities of Task Unit 6, Task Group 7.1, Joint Task Force SEVEN, during Operation Hardtack. Task Unit 6 was charged with the responsibility of providing radiological safety support for the Scientific Task Group, TG 7.1. The various chapters are devoted to a discussion of the activities engaged in by the Task Unit and the organization necessary to provide adequate radiological safety support for a weapons test operation of the magnitude of Operation Hardtack. Radiological survey results of the atolls following firing of the various devices are presented. Special problems arising during the operation are discussed. (auth)

22244 XRD-185
Joint Task Force One.
RADIOLOGICAL DECONTAMINATION OF TARGET AND NON-TARGET VESSELS. VOLUME 1. J. J. Fee. 146p. [1946]. Decl. Jan. 23, 1958. $22.80(ph), $7.20(mf) OTS.

Decontamination procedures which were carried out on naval vessels exposed to fallout during the Crossroads shot series are described. (C.W.H.)

22245 XRD-186
Joint Task Force One.
RADIOLOGICAL DECONTAMINATION OF TARGET AND NON-TARGET VESSELS. VOLUME 2. J. J. Fee. [1946]. Decl. Jan. 23, 1958. 146p. $22.80(ph), $7.20 (mf) OTS.

22246 XRD-187
Joint Task Force One.
RADIOLOGICAL DECONTAMINATION OF TARGET AND NON-TARGET VESSELS. Volume 3. J. J. Fee. [1946]. Decl. Jan. 23, 1958. 127p. $19.80(ph), $6.30(mf) OTS.

22247
RADIOACTIVE CONTAMINATION OF ARTIFICIAL ORIGIN OF THE ATMOSPHERE AND SOIL. Hubert Garrigue. Compt. rend. 249, 737-8(1959) Aug. 3. (In French)

The preliminary results of air contamination studies made with a specially equipped plane and automobile are presented. Data obtained at the observatory on the top of Puy de Dome are also included. The results show that even at altitudes up to 6000 m the radioactive contamination is measurable. (J.S.R.)

22248
DATA ON THE HYGIENIC CHARACTER OF THE DUST OF THE RARE METALS TANTALUM AND NIOBIUM. Yu. L. Yegorov. Gigiena Truda i Professional. Zabolevaniya 1, No. 6, 16-22(1957). (Translated from Referat. Zhur. Met. No. 7, 1958, p.330).

Studies of Ta and Nb showed that the dusts of these metals and their compounds are highly dispersable, and almost insoluble in liquid mediums with the pH close to that of biological mediums. Ta entering the gastrointestinal tract is almost eliminated by the intestines during the first few days. Its resorption through the intestinal tract is not observed. The total toxic action of Ta and Nb compounds is weak. The action of the dust of the materials studied on the pulmonary tissue (on respiratory entry and intra-tracheal introduction) differs depending upon the type of the dust. There are reasons for the assumption of the possibility of development of the fibrous process in the lungs upon the prolonged inhalation of the dusts of these compounds. Processes related to the evolution of the dust demand the application of dust removing devices.

22249
RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION. Rolf M. Sievert and Gioacchino Failla (International Commission on Radiological Protection). Health Phys. 2, 1-2(1959) July.

The International Commission on Radiological Protection has been functioning since 1928 when it was established, under the name of International X-ray and Radium Protection Commission, by the Second International Congress of Radiology held in Stockholm, Sweden. It assumed the present name and organizational form in 1950 in order to cover more effectively the

rapidly expanding field of radiation protection. Recommendations are presented which represent concepts and practices evolved from recent discussions at formal and informal meetings of the Commission and its Committees. (auth)

22250

Cs^{137} BIOSPHERIC CONTAMINATION FROM NUCLEAR WEAPONS TESTS. W. H. Langham and E. C. Anderson (Los Alamos Scientific Lab., N. Mex.). Health Phys. 2, 30-48(1959) July.

Weapons tests to the end of 1957 have produced about 6 and 11 Mc of Sr^{90} and Cs^{137}, respectively, of which about 1.9 and 3.4 Mc have been deposited as long-range fall-out. Average surface deposition levels of Sr^{90} and Cs^{137} in the north temperature population belt may be about 20 and 36 mc/mile^2, respectively, and the stratospheric reservoir may contain an additional 2.3 Mc of Sr^{90} and 4.2 Mc of Cs^{137}. Cesium-137 contamination of the atmosphere, and of drinking water, assuming they are in equilibrium with the rate of stratospheric fall-out, does not appear to be a serious potential hazard to man's health even though weapons tests continue indefinitely at the past rate. The ingestion of contaminated foods is the principal source of Cs^{137} in the population. At present it is not possible to determine whether cesium is entering the biosphere and man via direct contamination of vegetation or via soil integration and plant uptake. If its mode of entry is through the soil, the potential radiation hazard from continued tests may be a factor of about 4 greater than if it is entering by direct contamination of vegetation. Because of metabolic similarity of cesium and potassium, cesium levels in the biosphere are conveniently expressed as Cs^{137}/g K. The average 1957 Cs^{137} level in United States milk was about 32 per $\mu\mu$c/g K, and the level in the rest of the diet was about 20 $\mu\mu$c/g K. The average 1956, 1957, and 1958 (through July) levels in the United States population were about 41, 44, and 54 $\mu\mu$c/g K, respectively. Correlation of Cs^{137} levels in the population with levels in milk suggests a dietary discrimination factor of about 2 in favor of cesium over potassium in going from the diet to the body. Correlation of 1957 Cs^{137} levels in United States milk (expressed as $\mu\mu$c/g K per in. of rainfall) with geographic meteorological conditions suggests that the manner in which tropospheric air masses approach or traverse the latitudes of high stratospheric fall-out may be a factor in Cs^{137} and Sr^{90} surface deposition levels. The increase in Cs^{137} levels in milk and in the United States population from 1956 to 1957 was not proportional to the increase in integrated fall-out, suggesting direct contamination of vegetation as its route of entry into the biosphere. However, measured levels presently in the population are compatible with predictions based on ecological considerations. The average 30 year internal plus external Cs^{137} radiation dose in equilibrium with a continuing test rate of 10 MT of fission per year is estimated as about 300 mr, or about 10 per cent of natural background, and the average total 70 year bone marrow dose is estimated as about 500 mr (assuming Cs^{137} enters the biosphere via the soil). Assuming 30 to 50 r as the genetic doubling dose and a non-threshold response to radiation, indefinite testing at the rate of 10 MT of fission per year may produce 0.5 to 1 per cent increase in the incidence of mutations as a result of Cs^{137} biospheric contamination. If weapons tests are stopped, the increase in incidence of mutations from Cs^{137} would be about one-tenth of the above estimate. A comparison of the mean bone marrow dose from Sr^{90} and Cs^{137} suggests that Cs^{137} may pose a potential leukemogenic hazard comparable to Sr^{90}, if both are entering the biosphere via soil integration and plant uptake. If Cs^{137} is entering the biosphere via direct contamination of vegetation, its potential leukemogenic hazard is about one-fifth that of Sr^{90}. Present knowledge is not adequate to establish the nature of the dose-response relationship for somatic effects of radiation. Therefore, it is not possible at present to estimate the absolute leukemogenic hazard of either Sr^{90} or Cs^{137} fall-out. (auth)

22251

MEASUREMENT OF RADIOACTIVITY IN AIR FILTERS. E. J. Story and A. W. Waltnr (North Carolina State College, Raleigh). Health Phys. 2, 49-52(1959) July.

Measurements of the fall-out fission product activity that accumulates in the air filters employed in ventilation systems are described. A general method for determining the γ activity of pelletized filter samples using a NaI well-type crystal spectrometer is discussed. The photofraction of a well-type crystal was measured and data are presented for γ-ray energies from 0.12 to 1.12 Mev. It is suggested that building air filters be employed in monitoring programs connected with laboratories, reactors, and studies on fall-out. (auth)

22252

STRONTIUM-90 DISTRIBUTION IN THE HUMAN SKELETON. A. R. Schulert, E. J. Hodges, E. S. Lenhoff, and J. L. Kulp (Columbia Univ., Palisades, N. Y.). Health Phys. 2, 62-8(1959) July.

Strontium-90 is now present in the skeletons of all living persons throughout the world as a result of nuclear detonations. Since this isotope is nonuniformly distributed within the adult skeleton, it is necessary to define this distribution in order to more adequately estimate the resultant radiation hazard as well as to evaluate and compare data from a variety of bones of different individuals. The principal bones from many cadavers were analyzed. While some skeletons were assayed very extensively, the bulk of the investigation centered on rib, vertebrae, and long bone shaft. In the case of adults, an aliquot of the total body skeleton was also analyzed in each case. In adults the strontium-90 concentration per gram calcium in vertebrae, rib, and long bone shaft is 1.8, 1.1, and 0.5 times skeletal average, respectively. In newborns and young children, the distribution is much more uniform although these data are more limited. These findings together with the fact that stable strontium is uniformly distributed throughout the adult skeleton show that the nonuniformity of strontium-90 is a temporal function of changing diet. If radiation damage from strontium-90 is a threshold phenomena, the distribution is of particular importance since the highest local concentration areas will first exceed the threshold. If the damage is nonthreshold in character, the distribution is still of some significance since some areas (e.g., bone marrow) are presumably more susceptible to radiation damage than other areas. (auth)

22253

SAFETY ON THE NUCLEAR SHIP SAVANNAH. Richard P. Godwin, Preston P. Eddy, and Ralph K. Longaker (U. S. Atomic Energy Commission, Washington, D. C.). Public Health Repts. (U. S.) 74, 669-73(1959) Aug.

The nuclear-powered merchant ship, Savannah, is a combination passenger-cargo ship of the mariner class.

It is 595 feet long, has a 78-foot beam, and will have a fully loaded displacement of 21,800 tons. The ship will have a sea speed of 20 knots and a cruising radius in excess of 100,000 miles. With a 124-man crew, and additional space for observers and technicians, she will also be able to carry 60 passengers. The NS Savannah was launched on July 21, 1959. After a comprehensive test program and outfitting, sea trials are scheduled for the spring of 1960. The construction of the nuclear-powered ship posed new and unique problems in design and operation. Complete containment, retention of wastes, and other nuclear and nautical safeguards incorporated to ensure maximum safety are discussed. (C.H.)

22254

INVESTIGATION OF THE CHARACTERISTICS OF A SEDIMENTATION TANK BY A RADIOACTIVE TRACER TECHNIQUE. J. M. Valentine and M. M. Bluhm (Western Regional Hospital Board, Glasgow). Intern. J. Appl. Radiation and Isotopes 5, 302-4(1959) July.

A tracer experiment is described in which sodium-24 was used to determine the throughput time and dispersion of a sample of water passing through a radial flow sedimentation tank in a sewage purification works. (C.H.)

22255

A PORTABLE RADIOACTIVE SOLUTION CONTAINER. Bergene Kawin (General Electric Co., Richland, Wash.). Intern. J. Appl. Radiation and Isotopes 5, 305-6(1959) July.

A portable lead solution container is described which conveniently permits safe and convenient handling and transfer of radioactive solutions with minimal hazard. Its relatively light weight permits it to be manually moved or maintained in any position by use of only a clamp and a fixed ring stand. It excludes container breakage and gross contamination of working areas, and without exceeding permissible radiation exposure limits, obviates to a great extent remote handling of millicurie amounts of radioisotopes. (auth)

22256

ANALYSIS OF STRATOSPHERIC STRONTIUM^{90} MEASUREMENTS. L. Machta and R. J. List (U. S. Weather Bureau, Washington, D. C.). J. Geophys. Research 64, 1267-76(1959) Sept.

The detonation of large thermonuclear devices injects radioactive fission products into the stratosphere, which may remain there for months or years. Balloon-borne air filters were used to sample the stratosphere at altitudes from 50,000 to over 90,000 ft. The Sr^{90} data are shown and compared with estimates of the amount injected into the stratosphere. Limitations of the data are discussed. Several meteorological models suggested to explain the observed data are evaluated. (auth)

22257

HOW A FILM BADGE SERVICE OPERATES. J. F. B. Dealler (Ministry of Health and Medical Research Council, Sutton, Surrey, Eng.). Nuclear Power 4, No. 41, 191-4(1959) Sept.

An evaluation is presented on the two dosimeters commonly used in personnel monitoring, i.e., the ionization chamber and the photographic film. The design of a filter system for a film badge is given. The film monitors beta-, gamma-, and x-ray dosage and gives an indication of the dose. Thermal neutrons can be measured by replacing part of the tin filter with cadmium. The operation of a dosage recording service is described. (C.J.G.)

22258

NATURAL RADIOACTIVITY OF MARINE ORGANISMS. A. F. Fedorov (Artic Research Inst. of Marine Industry and Oceanography, Murmansk). Priroda 48, No. 4, 86-8(1959) Apr. (In Russian)

Data on the natural radioactivity, uptake, and concentration of radioactive elements from marine waters by plankton are discussed. (R.V.J.)

22259

X-RAY ABSORBING BUILDING MATERIALS. H. Feierabend. Silikat Tech. 9, 213-15(1958). (Translated from Referat. Zhur. Khim. No. 1, 1959, Abstract No. 2143.)

Cast concrete or concrete plates are recommended to be used for the protection against x rays (from 100 to 200 kw). The protective properties of concrete increase with an increase in the heavy spar content. When heavy spar is used as 50% of a filler, the thickness of a protective wall must be 12 cm. When an usual heavy concrete is used a protective wall of 30 cm thickness is required.

22260

PROTECTIVE MEASURES FOR THOSE THAT WORK WITH RADIOACTIVE SUBSTANCES. S. S. Gurvits. Zavodskaya Lab. 24, 1424(1958).

A review of the present regulations and norms of the Central State Health Inspection of the USSR concerning work with radioactive substances is presented. (TCO)

22261

PROTECTION IN DIAGNOSTIC RADIOLOGY. B. P. Sonnenblick, ed. New Brunswick, N. J., Rutgers University Press, 1959. 374p.

Thirty-six papers are presented, mostly taken from Radiology and the British Journal of Radiology. They are divided into sections on nature and extent of the problem, earlier reports, non-radiologists and fluoroscopy, history and significance of MPD, dose to patient and personnel, exposure of fetus and female genital tract, dental radiography, image intensification, hospital radioisotope service and atomic energy facility, gonad dose, heredity, natural sources, radiation control: principles and outlook, and summary of suggestions to increase protection. (T.R.H.)

INSTRUMENTS

22262 AECU-4308

California. Univ., Livermore. Radiation Lab.

A HIGH CURRENT SWITCH OF LOW INDUCTANCE. C. D. Nail. Mar. 25, 1959. 5p. (LE-306-1). $1.80 (ph), $1.80(mf) OTS.

A switch was constructed using three Type 5555 ignitrons, which has demonstrated an ability to deliver currents of 800,000 amperes at 20 kv, from a capacitor bank of ~130 microfarads. The current discharge is a decaying sinusoidal wave with a period of ~16.5 microseconds. (W.L.H.)

22263 AECU-4310

Washington. Univ., Seattle.

SWITCHING CIRCUITRY FOR HIGH-INTENSITY PULSED MAGNETIC FIELD APPARATUS. Y. B. Kim and E. D. Platner. June 1959. 21p. Sponsored by ONR and AEC under Contract Nonr-477(12). $4.80(ph), $2.70(mf) OTS.

In the production of high intensity pulsed magnetic fields by the discharge of a capacitor, it is difficult to make ordinary switching devices unidirectional. A switching circuitry was developed that is simple and can be used with any of the standard switching mechanisms, the chief disadvantage being that all the energy is dissipated during each field pulse. Experimental work is described by using ignitrons as the switching mechanism. (W.D.M.)

22264 AECU-4315

Illinois. Univ., Urbana. Digital Computer Lab.

DESIGN OF THE CORE STORAGE UNIT. Report No. 91. S. R. Ray. Aug. 20, 1959. 33p. Contract AT(11-1)-415. $6.30(ph), $3.00(mf) OTS.

The presently proposed physical arrangement of the memory and operation cycle is described. Various problems which were encountered in the memory design studies are described in detail. (W.L.H.)

22265 AERE-R-2926

United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.

THE APPLICATION OF TIME RESOLUTION TO A SPECTROGRAPHIC SOURCE. C. A. Baker. May 1959. 24p. $0.49(BIS).

An optical apparatus is described which can resolve the repetitive discharge of a spectrographic excitation source into 10 μsec intervals. The time-resolved spectra obtained with the Davis-Campbell source unit under various conditions have been studied and the implications are discussed with respect to spectrographic analysis. (auth)

22266 CF-59-8-86

Oak Ridge National Lab., Tenn.

TESTING OF DUMP VALVE TRIM IN THE VALVE TEST LOOP AND THE PERFORMANCE OF DUMP VALVES IN THE HRT. E. C. Hise. Aug. 3, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

The Homogeneous Reactor Test requires an emergency or dump valve for rapidly releasing the contents of the high-pressure systems to the low-pressure systems. In order to determine the most suitable trim material for this service, a loop was constructed and used to test a variety of materials under simulated reactor dump conditions. As a result of the tests both 347 and 17-4 PH stainless steels were recommended and used in the HRT dump valves. The HRT core dump valve has not been replaced since the beginning of critical operations. The blanket dump valve has been replaced twice since criticality; once apparently as a result of mechanical binding and once following a dump. (auth)

22267 CNI-14

Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.

STUDIO DI UN SERVOMECCANISMO DI POSIZIONE A RIFLESSIONE DI FORZA REALIZZATO CON FRIZIONI MAGNETICHE A PARTICELLE. (Design of a Force-Reflecting Positional Servomechanism with Magnetic Particle Clutches.) C. Mancini and A. Pulacci. June 1959. 46p.

A description is given of a force-reflecting positional servomechanism with magnetic particle clutches. The characteristics of such a servomechanism are studied. The study is based on the theory of linear quadrupoles and gives satisfactory results with respect to the analysis of the system stability and to its dynamic response. A mechanical analog system giving an intuitive and synthetic representation is obtained. Data on a force-reflecting servomechanism are tabulated. The laboratory experiments are described in detail. (tr-auth)

22268 LA-2298

Los Alamos Scientific Lab., N. Mex.

FIELD STUDY OF THE $AgPO_3$ GLASS PERSONNEL DOSIMETER (U. S. NAVY DT-60). E. R. Ballinger and P. S. Harris. Jan. 1959. 50p. Contract W-7405-eng-36. $1.50(OTS).

The U. S. Navy DT-60 dosimeter was evaluated under field type conditions as to its reproducibility and accuracy of gamma, x-ray, thermal and fast neutron, and mixed radiation responses. Gamma and x-ray responses from 25 to 600 rads at energies in excess of 200 kev were found to be accurate within 20% in 92% of 160 dosimeters examined. Because the DT-60 was found to have no detectable fast neutron response, effort was directed toward exaggerating the thermal neutron response to approximate the total neutron dose from a nuclear detonation and also toward eliminating any neutron response in a mixed neutron-gamma field. This was accomplished by various combinations of lithium, paraffin, and cadmium shielding. Data indicate that the DT-60 dosimeter can be modified to approximate more closely doses from specific types of mixed radiations; however, this generally detracts from its value in approximating other types of mixed radiation doses. A paired system of dosimeters, in conjunction with one of the fast neutron dosimetry systems is proposed as being the most satisfactory arrangement to approximate mixed radiation doses to personnel in the field. (auth)

22269 M-6845

Brown Univ., Providence.

A ROTARY VACUUM SEAL. Richard W. Roberts. [Jan. 13, 1959]. 4p. Contract AT(30-1)-2101. $1.80(ph), $1.80(mf) OTS.

A brass rotary vacuum seal is described for use in a molecular beam experiment. (W.L.H.)

22270 NAA-SR-Memo-4159

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

PHOTO ELECTRIC MICRO-MICRO AMPERE CURRENT SOURCE. S. G. Barnes. July 27, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

A μμ ampere current source capable of simulating the current generator characteristics of an ion chamber was developed for a device and/or method of verifying the current linearity and frequency response of high impedance power channels. The apparatus consists of a multiplier photo-tube excited by a variable intensity light source. The unit is portable and easily "T'd" into power channels at the ion chamber for use in the field calibration tests. (W.D.M.)

22271 NBS-TN-10

National Bureau of Standards, Washington, D. C.

CALCULATED BEHAVIOR OF A FAST NEUTRON SPECTROMETER BASED ON THE TOTAL ABSORPTION PRINCIPLE. James E. Leiss. Apr. 14, 1959. 37p. (PB-151369). $1.00(OTS).

Performance calculations for a total absorption fast neutron spectrometer are presented. The spectrometer detecting element is a boron-10-loaded liquid scintillator. By making the scintillator a thin disk, only those neutrons whose first collision is a large-energy-loss hydrogen collision have appreciable chance of remain-

ing in the spectrometer long enough to be captured. The expected energy resolution and efficiency of this type of spectrometer are determined, and are comparable to other types of fast neutron spectrometers. (auth)

22272 NP-7906
Cornell Univ., Ithaca, N. Y.
A PHOTON-COUNTING SPECTROMETER FOR ATTENUATION MEASUREMENTS IN THE SOFT X-RAY REGION. D. H. Tomboulian. Sept. 1959. 20p. Contract Nonr-401(37).

The characteristic emission bands of the light metals may be utilized successfully for the irradiation of absorbers, and the relatively weak bremsstrahlung from the heavier metals may also serve as a source of continuous radiation. A second result has to do with the intensity of the radiation which is scattered from the front surface of the absorber. Relying on electromagnetic theory in a general way, it has been assumed that, when the absorber is illuminated normally, losses due to scattering and reflection were negligible. Hence, in all measurements of the attenuation coefficient, the degradation of the incident beam is ascribed wholly to photoelectric absorption. This assumption was checked experimentally. With the absorber under normal illumination (λ = 180 A) the multiplier was turned about an axis through the absorber until the multiplier was situated so that it could receive photons scattered at various angles from the front surface of the absorbing foil. Over the range of directions lying between the tangent to the surface and a direction making 22° with the normal, the scattered intensity was too small to be observed. The tests included an Al foil and also a Zapon foil. It thus appears that for the particular physical specimens and for incident photon energies of about 70 ev, the diminution in the incident intensity may be associated with processes which absorb energy within the foils. (auth)

22273 SC-4337(TR)
Oklahoma State Univ., Stillwater. School of Electrical Engineering.
INVESTIGATION OF DYNAMIC CHARACTERISTICS OF RELAYS. Interim Report [for] period April 1 to May 31, [1959]. Aug. 1959. 80p. For Sandia Corp. $2.25(OTS).

The seven sections in this volume discuss the following subjects: dynamic performance of relays, comparison of induced voltage and coil current of a relay with a special coil, coil current and induced voltage using a search coil on the armature end, transient flux and coil current, changing discharge resistance and predicting release time, predicting spring bias, and switching panel used in testing relays. (W.L.H.)

22274 SC-4345(TR)
Oklahoma State Univ., Stillwater. School of Electrical Engineering.
INVESTIGATION OF DYNAMIC CHARACTERISTICS OF RELAYS. Interim Report [for] June 1 to July 31, 1959. Sept. 1959. For Sandia Corp. 137p. $2.75(OTS).

Items studied included relation of air gap and back tension for constant operate time, effect of variable heel gap on armature closure and release time, influence of variable voltage on armature transit time and operate time with constant steady state current, differences in relays of the same type, influence of parameters on the transient coil current of a relay, and logical conclusions from individual analysis. (W.D.M.)

22275 SCTM-132-55(52)
Sandia Corp., Albuquerque, N. Mex.
CREEPAGE TEST OF SR-4 STRAIN GAGES UNDER HIGH STEADY STATE STRAINS. Loyt L. Lathrop. June 22, 1955. 4p. $1.80(ph), $1.80(mf) OTS.

The stability of the SR-4 paper base gages are compared with (A-7 and A-14) with that of SR-4 bakelite base gages (AB-14) under high steady strain. The paper base gages have a tendency to creep when subjected to steady strains and reduce the stress in the wire grid of the strain gage. The SR-4 bakelite base gage is quite stable except for a small creep during the first hour or so of applied strain. This creep can be materially reduced by cycling the gage between maximum expected strain and zero strain several times before starting the test. (auth)

22276 SCTM-197-55(51)
Sandia Corp., Albuquerque, N. Mex.
BROADBAND PULSE TRANSFORMER WITH MILLIMICROSECOND RISE TIME. Elliot N. Pinson. Sept. 23, 1955. 15p. $3.30(ph), $2.40(mf) OTS.

A type of coaxial pulse transformer utilizing magnetic core materials for use in the millimicrosecond to five microsecond region is discussed. The transformer serves as a pulse height doubler and an unbalanced to balanced voltage converter. A rise time of the order of 2 mμs was achieved and less than 5 per cent decay was introduced into pulses up to five microseconds duration. (auth)

22277 SCTM-219-55(53)
Sandia Corp., Albuquerque, N. Mex.
ON THE RELATIONSHIP BETWEEN DC LARGE SIGNAL CURRENT GAIN AND AC SMALL SIGNAL CURRENT GAIN FOR A COMMON BASE TRANSISTOR CONNECTION. T. E. Lommasson. Oct. 25, 1955. 4p. $1.80(ph), $1.80(mf) OTS.

Approximate relationships between d-c and a-c short circuit current gain figures for low level and medium range values of emitter current are derived. Gain measurements for d-c current can easily be made for low level emitter currents, but a-c small signal current gain measurements are difficult to obtain in this region. For this reason quantitative relations between A and h_{21cb} are desirable for use in the design of starved base amplifiers and similar low level circuitry. (auth)

22278 SCTM-273-55(53)
Sandia Corp., Albuquerque, N. Mex.
"h" PARAMETER TABLES. T. E. Lommasson. Dec. 20, 1955. 9p. $1.80(ph), $1.80(mf) OTS.

Tables relating the small signal "h" parameters of transistors to the equivalent "T" network parameters are given. Exact and approximate relations between "h" parameters in the different connections in terms of common base parameters are presented. Equations relating circuit properties to device "h" parameters are given. Comments on the use of the tables and equations are offered. (auth)

22279 UCLA-446
California. Univ., Los Angeles. School of Medicine.
PHOTOGRAPHIC DOSIMETRY: AN ANNOTATED BIBLIOGRAPHY. Ruth W. Brisbane and Louis B. Silverman, comps. Sept. 15, 1959. 212p. Contract AT-04-1-GEN-12. $3.50(OTS).

Annotated references to unclassified report, book, and journal literature, both domestic and foreign, con-

cerning the quantitative evaluation of radiation dosage by means of photographic films and nuclear emulsions is presented. Reports in the field of nuclear physics which contain information of use in the field of dosimetry are included, as are those concerning quantitative autoradiography. (auth)

22280 UCLA-447

California. Univ., Los Angeles. School of Medicine.
SOME FURTHER MODIFICATIONS AND TECHNIQUES APPLIED TO THE RCA TYPE EMU ELECTRON MICROSCOPE. Francis W. Bishop. Sept. 23, 1959. 35p. Contract AT-04-1-GEN-12. $1.00(OTS).

A compilation of information on a number of modifications or improvements in the E.M.U. electron microscope which were made during the last five years is presented. Most of the material applies specifically to the R.C.A. instrument, however, much of it can be applied to other units. The purpose of these developments has been to simplify the operation of the microscope and to improve quality of the results. (auth)

22281 UCRL-5656

California. Univ., Livermore. Lawrence Radiation Lab.
TRANSISTOR DRIVEN BEAM SWITCHING TUBE DECADE COUNTER. Richard H. Graham. Aug. 11, 1959. 15p. Contract W-7405-eng-48. $3.30(ph), $2.40(mf) OTS.

An electrical readout, decade counter employing a magnetron beam switching tube with transistor drive is described. Double pulse resolution is one microsecond. The unit will accept a variety of transistor types and will tolerate supply voltage variations of ±20% at ambient temperatures up to 60°C. A neon indicator is driven without the use of additional transistors. A readout circuit for printer on punched paper tape is presented. (auth)

22282 WADC-TN-59-103

Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.
DESIGN AND CONSTRUCTION OF A GASEOUS XENON PARTICLE DETECTOR. Raymond H. Kelley. May 1959. 16p. Project No. 7112. (AD-216088).

The techniques for building stable, demountable, gaseous xenon particle detectors are described. The aspects of design, construction, and use which are most apt to be troublesome are considered in detail. Spectra obtained with U^{235}, Po^{231}, and Po^{210} alpha sources (from detectors constructed by these techniques) are displayed. (auth)

22283 AEC-tr-3800

A NUCLEAR RESONANCE SPECTROGRAPH WITH HIGH RESOLUTION. PART II. DESCRIPTION OF THE APPARATUS. H. Primas and Hs. H. Gunthard. Translated for Argonne National Lab. from Helv. Phys. Acta 30, 315-30(1957). 16p. $3.30(ph), $2.40(mf) JCL.

A nuclear induction spectrograph with a resolving power of 10^{-6} is described, constructed specially for use in molecular physics and for elucidating the structure of organic substances. The construction of a permanent magnet with a field of approximately 6000 gauss, of a crystal transmitter with a short time stability of 10^{-9}, and of a nuclear induction head with an electronic leakage compensation is discussed in detail. The measuring head is distinguished by a specially symmetric construction and allows the use of rotating specimens with a volume of only a few mm^3. (auth)

22284 AEC-tr-3804

AN APPARATUS SENSITIVE TO ACCELERATION. Frithiof Victor Johnson. Translation of German Patent Office document Auslegeschrift 1,023,257. [1958]. 8p. $1.80(ph), $1.80(mf) JCL.

The design of an accelerometer is presented. The device has a pivoted container whose rotation axis does not go through the point of gravity, so that a torque is exercised on the container when linear accelerations do not lie in the plane defined by the rotation axis and the point of gravity. A scanning device is incorporated which gives a signal whenever the container moves out of its position of rest. In the container there is an electromotor whose stator is mounted on the container and whose rotor propels a flywheel mass, so that a reaction moment is exercised on the container when the rotor is accelerated. (W.L.H.)

22285 AEC-tr-3830

A HIGH PRECISION PHOTOELECTRIC SPECTRO-PYROMETER. V. V. Kandyba and V. A. Kovalevskii (Kovalevsky). Translated from Doklady Akad. Nauk S.S.S.R. 108, 633-5(1956). 7p. $1.80(ph), $1.80(mf) JCL or LC.

An objective spectropyrometer was developed for calibrating standard temperature lamps. The calibration is accomplished in the light of different wave lengths in the spectral range of 0.45 to 0.85 microns with a precision surpassing that of the visual pyrometers. (W.L.H.)

22286 AEC-tr-3849

MEASUREMENT OF WEAK ACTIVITIES IN CARBON 14 AND TRITIUM BY A SCINTILLATION METHOD. R. Bibron. Translated from Onde élec. 39, 40-5(1959). 11p. $3.30(ph), $2.40(mf) JCL.

Low activities of carbon-14 and tritium may be measured by coincidence counting of the refrigerated scintillating liquid containing the samples of unknown activity. (C.W.H.)

22287

INVESTIGATIONS OF NUCLEAR EMULSIONS LOADING BY BORON AND LITHIUM. V. Labew and M. Nikolae. Acad. rép. populaire Roumaine, Rev. phys. 4, 99-107(1959). (In Russian)

Methods of loading nuclear emulsion with boron and lithium are described. It is shown that a relative determination of neutron flux can be achieved by counting the 6- to 9-μ tracks recorded per unit of surface in nuclear layers loaded to standard saturation. Absolute determination requires a preliminary standard source calibration. The recording of tracks per unit of surface has an order of accuracy of 2 to 8%; the error rises with the increase of boron concentration per cm^3 of emulsion. According to the investigated absorption isotherm, at standard temperature and pH, emulsions with 10 to 120 mg of B per cm^3 and 3.5 to 20 mg of Li per cm^3 can be prepared using NIKFI (Scientific Research Inst. of Motion Picture and Photography) emulsion. (R.V.J.)

22288

ACCELERATING APPARATUS WITH CASCADE GENERATOR FOR 800 kv. K. Simonyi. Acta Tech. Acad. Sci. Hung., 19, 353-62(1958). (Translated from Referat. Zhur. Fiz. No. 12, 1958, Abstract No. 26780).

Description of such an apparatus is presented. The individual problems such as filament supply to the rectifying tubes, focusing of the ions, etc., are examined in detail.

22289

MICROWAVE METHOD OF INVESTIGATING THE AFTERGLOWS OF PULSED GASEOUS DISCHARGE. M. C. Sexton, J. J. Lennon, and M. J. Mulcahy (Univ. of Liverpool). Brit. J. Appl. Phys. 10, 356-9(1959) Aug.

An apparatus suitable for recording the decrease of electron density in the afterglows of pulsed microwave discharges at 3 and 10 cm wavelengths is described. The well-known method of measuring the frequency shift induced in a resonant cavity by the presence of free electrons was employed, but a new method was developed for detecting the resonant reflexions which uses a hybrid T-junction. Modifications to the frequency-modulation method of probing the afterglow, which are particularly suitable for the analysis of slowly decaying plasmas, are described. An account is also given of a vacuum system suitable for handling high purity gases. (auth)

22290

A 250-CURIE CAESIUM 137 UNIT DESIGNED FOR LOW DOSAGE RATES AT SHORT SOURCE TO SKIN DISTANCES. G. F. Whitmore and H. E. Johns (Ontario Cancer Inst., Toronto). Brit. J. Radiol. 32, 533-8(1959) Aug.

A 250-curie cesium-137 unit is described and illustrated schematically which was designed to produce a small depth dose. The unit was designed specifically for treatment in the head and neck region. Interchangeable treatment cones provide a variety of circular and rectangular fields. (C.H.)

22291

RADIOLUMINESCENT DOSIMETRY. Lucien Mallet and Henri Constans. Compt. rend. 249, 953-5(1959) Sept. 7. (In French)

A radiation measurement apparatus is described which utilizes the luminescence produced in transparent organic media by high-energy radiation. The organic material, a styrene polymer for instance, is placed at one end of a light-conducting tube and is connected optically to a photomultiplier-integrator arrangement. The device is useful in radiobiology research for gamma radiation intensity measurements in tissues or tissue equivalents. (T.R.H.)

22292

THERMISTORS MEASURE LOW LIQUID VELOCITIES. H. E. Wingo (E. I. du Pont de Nemours and Co., Aiken, S. C.). Control Eng. 6, No. 10, 131, 133(1959) Oct.

A modification of a hot-wire anemometer was designed to explore the three-dimensional flow pattern of filtered, deionized water in a large, partially baffled tank. (C.J.G.)

22293

ENERGY SPECTRUM OF ALPHA PARTICLES FROM SOURCES OF VARIOUS THICKNESS. Ivo Chudacek (Karlovy Univ., Prague). Czechoslov. J. Phys. 8, 319-25(1958). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 7476).

The energy spectrum of the alpha particles emitted by sources of various thicknesses, made of U_3O_8, were investigated. The spectrum was measured with an Agfa K2 nuclear emulsion 200 microns thick. The actual energy spectrum N(E)dE can be approximated by the semi-empirical expression $N(E)dE = K(E_0^{1/2}-E^{1/2})^2 E^{\varkappa}dE$ (where E_0 is the initial particle energy, and K and $\varkappa$ are certain constants).

22294

PRINCIPAL RELATIONSHIPS IN THE DESIGN OF MECHANICAL NEUTRON SELECTORS. Jaromir June (Inst. for Nuclear Physics, Academy of Sciences, Czechoslovakia). Czechoslov. J. Phys. 8, 362-8(1959). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 7460).

Equations of motion are derived for neutrons in a coordinate system, connected with the rotor of the selector, as are the relations between the bandwidth of the transmitter energy, the width of the slit, the curvature of the slit, and the effective width of the slit for neutrons of various velocities. From geometrical considerations the author derives a relation for the aperture of the apparatus. The minimum distance between the detector and the selector, necessary to be able to use all the channels of the time analyzer, is established.

22295

HOW TRANSISTOR DRIVES COLD-CATHODE COUNTER. H. Sadowski and M. E. Cassidy (U. S. Atomic Energy Commission, New York). Electronics 32, No. 38, 46-7(1959) Sept. 18.

An automatic recording system utilizing a large number of compact modular decade counters capable of storing data with visual and electronic readout is reported. These units are connected in parallel to a 10-digit bus bar system for readout at a remote station. The cold-cathode counter tube is driven by one transistor blocking oscillator. The maximum repetition rate of the system is slightly greater than 2,000 pulses per second. Waveform criteria for successful operation are discussed. (C.J.G.)

22296

GAMMA RESPONSE AND ENERGY LOSSES IN THE ABSOLUTE FAST NEUTRON DOSIMETER. E. B. Wagner and G. S. Hurst (Oak Ridge National Lab., Tenn.). Health Phys. 2, 57-61(1959) July.

The γ response and the associated question of the neutron energy lost under the bias needed to discriminate γ radiation in the fast neutron dosimeter is considered for the cases where the γ-ray dose rate is high (> 1 r/hr). The particular dosimeter considered is the so-called absolute fast neutron dosimeter which is calibrated by means of an internal α-source. Basic data are given for effective energies of 100 kve and 200 kve x-rays and Co^{60} γ-radiation. For very high γ-ray intensities (from 10 to 100 r/hr) a graphical method of treating the pulse height distribution data is suggested. Thus, for example, a dose rate of 1 mrad/hr of Po-Be neutrons can easily be determined even when the γ-dose rate is as high as 100 r/hr. (auth)

22297

IMPROVED CASCADE IMPACTOR FOR MEASURING AEROSOL PARTICLE SIZES. R. I. Mitchell and J. M. Pilcher (Battelle Memorial Inst., Columbus, Ohio). Ind. Eng. Chem. 51, 1039-42(1959) Sept.

Studies on the jet-to-slide distance which affects the sharpness of classification, and on wall-to-slide distance which affects the loss of particles on the wall were emphasized particularly. An improved cascade impactor containing round jets and slides was designed and calibrated. Problems encountered in the calibration process were studied and solved. Studies of the wall loss that may be expected for each stage of the impactor were made. This improved impactor and modi-

fied versions have been used to determine the particle size distribution of air polutants, therapeutic and biological aerosols, and cigarette smoke. (auth)

22298

A CARTESIAN MANOSTAT FOR PRECISE DIFFERENTIAL PRESSURE CONTROL. E. C. Evans and P. E. Melroy (Oak Ridge Gaseous Diffusion Plant, Tenn.). ISA Journal 6, No. 10, 39(1959) Oct.

The design is given for a modified Cartesian Manostat for the control of a system operating with a differential pressure of 3 cm Hg and a higher pressure varying from 80 cm Hg to 10 cm Hg absolute and with a flow rate from 0.2 to 100 standard cubic centimeters of gas per minute. (C.J.G.)

22299

EXPERIMENTAL DATA ON THE LUMINESCENT METHOD OF GAMMA-RADIATION DOSIMETRY. I. Ye. Konstantinov. Issledovaniya v Oblasti Doximetrii Ioniziruyushchikh Izluchenii, Sbornik Statei, 98-101(1957). (Translated from Referat. Zhur. Elektrotekhn. No. 2, 1959, p.151-2).

Examination of the hardness course in luminescent crystals of NaI(Tl) naphthalene (activated by anthracene) and stilbene with respect to gamma-radiation dose rate is described. The photomultipler current was compared with the saturation current of a thimble ionization chamber that had no hardness course within the energy range in question. Gamma-radiation sources such as Sn^{113} (350 kev), Cs^{137} (661 kev), and Co^{60} (1.25 Mev) were used. All investigated crystals had the hardness course. The ratio of the photomultipler current to the chamber current grows with higher gamma-radiation energy for stilbene and naphthalene and drops for NaI(Tl). The minimum gamma-radiation dose rate that can be measured by the luminescent method was determined for a NaI(Tl) crystal. Feasibility of constructing a luminescent gamma-radiation dosimeter for measuring a dose rate of 10^{-9} roentgen/sec is noted. (TCO)

22300

MEASURING SMALL CONCENTRATIONS OF ALPHA-ACTIVE SUBSTANCES IN WATER BY A DIFFUSION CLOUD CHAMBER. V. I. Popov. Issledovaniya v Oblasti Dozimetrii Ioniziruyushchikh Izluchenii Sbornik Statei, 154-61(1957). (Translated from Referat. Zhur. Elektrotekh. No. 3, 1959, p.149).

A diffusion cloud chamber filled with ethyl or methyl alcohol vapor was used. A sample was placed on the bottom of the chamber cooled by dry ice, and tracks were visually counted for about 3 min. The results showed that to measure accurately small concentrations of alpha-active substances in water, it is necessary to evaporate the water to a dry deposit. The upper limit of the measurement is 5×10^{-11} curie. liter; the lower limit is determined by the dilution of the samples. Measurement error is ± 10%. (TCO)

22301

IMPROVED METHOD FOR PERSONAL PHOTOMONITORING OF GAMMA HAZARD (IFK-11). N. S. Nikitin and V. V. Frolov. Issledovaniya v Oblasti Dozimetrii Ioniziruyushchikh Izluchenii Sbornik Statei, 680-3(1957). (Translated from Referat. Zhur. Elecktrotekh. No. 3, 1959, p.150).

The existing method of monitoring gamma-radiation with photofilm has disadvantages due to the following factors: results depend on radiation energy; sensitivity is low; measurement of the degree of blackening by a densitometer is subjective. Steps to overcome these disadvantages are considered. The photofilm is most sensitive to soft gamma radiation. To compensate for this, filters are used that comprise a layer of lead and a layer of aluminum. Lead ensures greater absorption of soft gamma radiation, while aluminum protects the emulsion against secondary electrons knocked out of lead. To increase sensitivity, the compensating filters are used in combination with intensifying screens prepared from calcium tungstate. The optimum thickness of a lead filter with an intensifying screen is 1.5 to 1.6 mm; without the screen, 0.75 to 0.8 mm. The thickness of the aluminum layer is 0.5 mm. A compensation-type photometric scheme with selenium phototubes was used for objective evaluation of blackening. (TCO)

22302

THE DETERMINATION OF MOISTURE IN BUILDING MATERIALS BY THE METHOD OF GAMMASCOPY. L. G. Polozova and R. P. Reizman. Izvest. Akad. Nauk Eston. S.S.R. Ser. Tekh. i Fiz.-Mat. Nauk 6, 122-9(1957). (Translated from Referat. Zhur. Khim. No. 1, 1959, Abstract No. 1595.)

A technique for determining moisture in building materials by irradiating them with gamma rays is described. The magnitude of gamma rays which were absorbed by the material is the measurement of its moisture. Co^{60}, with an activity of ~7 millicuries, was used as the source of irradiation. Other isotopes with a softer radiation are also recommended. (auth)

22303

EXPOSURE TIME IN THE X-RAYING OF STEEL WITH 25-Mev BETATRON RAYS. V. I. Gorbunov. Izvest. Tomsk. Politekh. Inst. im. S. M. Kirova, No. 87, 422-30 (1957). (Translated from Referat. Zhur. Met., No. 12, 1958, p.194).

Exposure curves for a darkening density D = 2 which were obtained experimentally in photographing steel articles up to 500 mm thick on a betatron with radiation energy of 25 Mev are adduced; 5 types of film were used. In photography with 2FPF3 screens the films range in the following sequence according to sensitivity: Ilford, Agfo-Duro, Roentgen X-5, and Roentgen-X. Roentgen-XX film can be used expediently with 2P3 screens for thicknesses up to 200 mm only.

22304

HIGH-SPEED SUPERCONDUCTIVE SWITCHING ELEMENT SUITABLE FOR TWO-DIMENSIONAL FABRICATION. V. L. Newhouse and J. W. Bremer (General Electric Co., Schenectady, N. Y.). J. Appl. Phys. 30, 1458-9(1959) Sept.

Experiments on the superconducting-to-normal transition of tin films due to the magnetic field of current in an adjacent transverse film are reported. The effective time constant of the experimental device is calculated as $\tau \approx 20\ \mu$sec for I = 40 ma. (C.J.G.)

22305

A SIMPLE ARRANGEMENT, USING A STANDARD GEIGER-MÜLLER TUBE, FOR THE CONTINUOUS MONITORING OF RADIOACTIVE EFFLUENTS FROM A CHROMATOGRAPHY COLUMN. H. E. Dobbs (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chromatog. 2, 572-4(1959) Sept.

22306

COINCIDENCE CIRCUIT USING TIME-AMPLITUDE CONVERSION. S. Gorodetzky, Th. Muller, M. Port, G. Bergdolt, and J. Graff. J. phys. radium 20, Suppl. No. 7, 49A-54A(1959) July. (In French)

A time-to-pulse height converter was studied. With the clipping lines used, the converter has a linear region of 0.5×10^{-8} sec and a variation in delay of 2.5×10^{-11} sec corresponds to a variation in amplitude of 1%. (auth)

22307

A STABLE GASEOUS SCINTILLATOR USING ARGON WITHOUT WAVELENGTH CHANGES. A. Perrin and R. Chéry (Institut de Physique Nucléaire, Lyon). J. phys. radium 20, Suppl. No. 7, 92A-4A(1959) July. (In French)

A gas scintillator without wavelength changes was built. The apparatus offers fast stable operation with only a rudimentary filling device. The resolution has an excessively high limit because of the number of relatively weak photoelectrons does not permit the use of Ar for spectrometry. For spectrometry it is necessary to use Xe which permits a theoretical resolution of 8% for 5.3-Mev particles, but a gas recovery and purification system is necessary because of the high price of Xe. (T.R.H.)

22308

INDUCED CONDUCTIVITY OF CdS BY β- AND γ-RAYS. Sumiaki Ibuki (Mitsubishi Elec. Mfg. Co., Amagasaki, Japan). J. Phys. Soc. Japan 14, 1196-1204(1959) Sept.

Properties of CdS crystals were investigated under irradiation by β rays from 10 mc of Sr^{90} or from an accelerator of the Van de Graaff type and γ rays from 1 c of Cs^{137} or from 200 c of Co^{60}. The ohmic contact of electrodes and the crystal uniformity were first inspected, and some properties concerning the induced conductivity of CdS crystals by β and γ rays were discussed in comparison with those observed when the crystals were irradiated by visible light. It was concluded that the sample crystals grown are uniform and that they have low trap density and high sensitivity for β or γ rays. It was also shown that the elementary phenomena of the induced conductivity in the case of β or γ ray irradiation were quite similar to those in the case of visible-light irradiation, and that the number of electrons excited into the conduction band by a β particle was about one hundred times larger than that by a γ particle of 1.3 to 1.5 Mev. (auth)

22309

MEASUREMENT OF SYSTEMATIC TRACK DISTORTION IN A PROPANE BUBBLE CHAMBER. W. H. Evans, D. W. Hadley, T. D. N. Morgan, P. R. Williams, and A. Kirk (Univ. of Liverpool). J. Sci. Instr. 36, 365-7(1959) Aug.

Systematic track distortions caused by turbulent motions were measured and compared in a propane bubble chamber, $6 \times 2 \times 2$ in., which was operated both by single-piston and multiple-bellows expansion systems. (C.J.G.)

22310

INVESTIGATION OF CERTAIN CHARACTERISTICS OF THE DISCHARGE IN GEIGER-MUELLER COUNTERS. Jozsef Koch. Magyar Fiz. Folyóirat 5, No. 3, 208-16 (1957). (Translated from Referat Zhur. Fiz. No. 7, 1958, Abstract No. 14920.)

The pulses were investigated in self-quenching Geiger-Mueller counters filled with a mixture of argon and ethyl alcohol. The speed of propagation of the discharge in the counter turns out to be approximately proportional to the overvoltage and the current seems proportional to the square of the overvoltage.

22311

FLOW-THROUGH GEIGER-MUELLER COUNTER. Daniel Vodros. Magyar Fiz. Folyóirat 5, No. 4, 349-51(1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 14921.)

A description is given of a flow-through Geiger-Mueller counter of the ordinary type for the registration of low-energy particles.

22312

QUENCHING CIRCUIT FOR GEIGER-MUELLER COUNTERS. Jozef Koch. Magyar Fiz. Folyóirat 6, 133-42(1958). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 7449).

A description is given of a quenching electronic circuit with which it is possible to reduce substantially the dead time of the counter.

22313

VAN DE GRAAFF ACCELERATOR FOR 1 Mv, OF THE DIVISION OF THE ATOMIC PHYSICS OF THE CENTRAL RESEARCH PHYSICS INSTITUTE. Istvan Berkes, Istvan Demeter, and Pal Kostka (Atomfizikai Osztaly, Hungary). Magyar Fiz. Folyóirat 6, 209-23(1956). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 7404).

A description of the power supply and the accelerating portion of the Van de Graaff 1 Mv generator is given. The generator accelerates electrons to energies of 200 to 800 kev. The maximum current of the accelerated particles reaches 40 ma. The voltage is measured with the aid of a deflecting magnet with an accuracy of ± 1.2%. The maximum current of the deflected beam is 8 ma. It is possible to operate with the beam both in vacuum and in air. (auth)

22314

600 kv CASCADE GENERATOR WITH HIGH FREQUENCY SUPPLY. Gabor Kalman and Laszlo Varga. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 402-13(1957). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 7405).

A detailed description is given of the generator and accelerating tube. The frequency of the generator is 230 kc. The ion source is also fed at radio frequencies.

22315

SIMPLE SINGLE-CHANNEL DIFFERENTIAL DISCRIMINATOR. Akos Albert. Magyar Tudomanyos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 599-607(1957). (Translated from Referat. Zhur. Fiz. No. 3, 1959, Abstract No. 4998.)

This paper was previously abstracted from the original language and appears in NSA, Volume 12, as Abstract No. 16525.

22316

REDUCTION OF DEAD TIME OF OVERLOADED PULSE AMPLIFIERS. Antal Csakany. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 608-12(1957). (Translated from Referat. Zhur. Fiz. No. 3, 1959, Abstract No. 5009.)

In γ spectroscopy it is necessary to have linear amplification of weak pulses in the presence of strong pulses. An amplifier that satisfies these conditions is described.

22317

PRECISION AUTOMATIC CLOUD CHAMBER. Gyula Csikai, Gyula Hrehuss, and Sandor Szalay. Magyar Tudományos Akad. Mat. Fiz. Tudományok Osztályának

Közleményei 7, No. 2, 137-44(1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 14941.)

A detailed description is given of a cloud chamber constructed in the Debrecen Institute of Nuclear Physics, Hungary.

22318

PREPARATION AND PROPERTIES OF A NEW NUCLEAR EMULSION. Laszlo Medveczky and Alfred Polster. Magyar Tudományos Akad. Mat. Fiz. Tudományok Osztályának Közleményei 7, No. 2, 145-62 (1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 14974.)

A detailed description is presented of the technology of preparing a photoemulsion suitable for an extensive range of nuclear investigations. Information is given on the choice of gelatine, silver halides, method of washing the pictures, and determination of sensitivity. The properties of the emulsion obtained are also considered from the point of view of the nuclear physics. The emulsion is capable of fixing electrons with energies up to 0.03 Mev, protons with energies up to 50 Mev, and α particles with energies up to 150 Mev.

22319

ELECTRONICS FOR RADIATION DETECTION. I. TYPICAL SYSTEMS AND PULSE AMPLIFIERS. K. Kandiah (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 4, No. 41, 95-100(1959) Sept.

Electronic techniques associated with various radiation detection systems and pulse amplifiers are discussed. (C.J.G.)

22320

MASS SPECTROSCOPY AS A RESEARCH TOOL. A. H. Turnbull (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 4, No. 41, 108-11(1959) Sept.

The basic physics involved in the design of the mass spectroscope is discussed. Geological applications of the mass spectroscope are discussed. (C.J.G.)

22321

GLASS DOSIMETRY. Norbert J. Kreidl and Gerald E. Blair (Bausch and Lomb Optical Co., Rochester, N. Y.). Nucleonics 17, No. 10, 58(1959) Oct.

Optical-absorption and luminescense changes due to irradiation are most applicable to dosimetry. The dose range covered by existing systems is from 1 rad to 5×10^6 rads. The properties of various glasses are discussed. (C.J.G.)

22322

PHOTOGRAPHIC METHODS. H. F. Nitka (Ansco Research Labs., Binghamton, N. Y.). Nucleonics 17, No. 10, 58-9(1959) Oct.

The advantages of print-out dosimetry, the photolytic reduction of silver without development are indicated. The uses of special emulsions and commercial x-ray film in measuring large doses of radiation are discussed. (C.J.G.)

22323

LUMINESCENCE DEGRADATION. Frank H. Attix (Naval Research Lab., Washington, D. C.). Nucleonics 17, No. 10, 60-1(1959) Oct.

The use of organic systems such as anthracene, p-quaterphenyl, and quinine in water and diphenyloxazole in xylene in measuring large doses of radiation is discussed. An "exciton" theory for the explanation of luminescence degradation is given. Degradation characteristics of various scintillators and lumiphors are given in connection with an equation which describes the decrease in scintillation efficiency. (C.J.G.)

22324

PLASTICS DOSIMETRY. Charles Artandi (Ethicon, Inc., Somerville, N. J.). Nucleonics 17, No. 10, 62-63 (1959) Oct.

A discussion is given on the physical, mechanical, and chemical changes various plastics undergo at various radiation doses. (C.J.G.)

22325

MICROBIAL MONITORS. Velma L. Chandler (Ethicon, Inc., Somerville, N. J.). Nucleonics 17, No. 10, 63-64 (1959) Oct.

The use of microbial monitors in radiation sterilization is discussed and the resistances of several bacterial spores to radiation are given. (C.J.G.)

22326

TOTAL-DOSE STANDARDS. Samuel I. Taimuty (Stanford Research Inst., Menlo Park, Calif.). Nucleonics 17, No. 10, 65-6(1959) Oct.

The principles of the adiabatic and compensated calorimeter methods and the Fricke ferrous sulfate dosimeter are discussed as standards for dosimetry. (C.J.G.)

22327

RATE MEASUREMENTS. Samuel I. Taimuty (Stanford Research Inst., Menlo Park, Calif.). Nucleonics 17, No. 10, 66-7(1959) Oct.

Radiation dose rates are determined by such instruments as Faraday chambers, secondary-emission chambers, ionization chambers, and semiconductor devices. The operating principles of these instruments are discussed. (C.J.G.)

22328

A COMPARISON OF DOSIMETRY METHODS. Paul Schall, Jr. (Battelle Memorial Inst., Columbus, Ohio). Nucleonics 17, No. 10, 68-71(1959) Oct.

A table of characteristics of 24 dosimetry systems is given. The characteristics include: permissible dose rates, cost of equipment, cost per routine measurement, time for routine measurement, fraction of permanent change, and advantages and disadvantages of the dosimetric method. (C.J.G.)

22329

CHEMICAL DOSIMETRY. David E. Harmer (Dow Chemical Co., Midland, Mich.). Nucleonics 17, No. 10, 72-6(1959) Oct.

A table is given listing over forty methods available in chemical dosimetry. (C.J.G.)

22330

INSTRUMENT DEVELOPMENT AT SAVANNAH RIVER. [PART I]. NONDESTRUCTIVE-TESTING EQUIPMENT. J. N. Wilson (E. I. du Pont de Nemours and Co., Aiken, S. C.). Nucleonics 17, No. 10, 90, 92, 94, 96(1959) Oct.

Instruments designed at Savannah River for preoperational testing of reactor fuels and control components are described. Designs and operational procedures are given for an ultrasonic tester for unbonded areas under uranium slug cladding, an eddy-current tester, and mechanical and radiation gages. (C.J.G.)

22331

A FAST NEUTRON TIME-OF-FLIGHT SPECTROMETER. G. Hrehuss, A. Neszmelyi, and K. Simonyi (Polytechnic Univ., Budapest). Periodica Polytech.

(Elec. Eng.) 2, 131-40(1958). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 7458).

A description of a procedure and an experimental setup for the measurement of neutron spectra at 0.8 to 14 Mev is given. The spectrometer is intended for the measurement of spectra of inelastic scattering of (DD) and (DT) neutrons by various nuclei. The experimental arrangement is similar essentially to that employed by Cranberg and Levin (Referat. Zhur. Fiz., 1957, No. 4, 8792). Brief neutron pulses (2 to 3 millimicrons-seconds) were obtained by deflecting the deuteron beam, incident on the diaphragm, by means of a high frequency electric field. Deuterons with energies of 200 kv, were obtained with a Cockcroft-Walton generator. The pulsating current of the deuterons incident on the target amounted to approximately 1 microampere. With such a current, the yield of (DD) and (DT) neutrons amounted to 10^6 and 10^7 neutrons per second, respectively. The neutrons were detected with a scintillation counter. The measurement of the time-of-flight were made with a single-channel system, which registered the coincidences between the pulses corresponding to the deuteron pulses, shifted by a suitable phase, and the pulses from the scintillation counter. The resolving time of the coincidence circuit is 3×10^{-9} sec. The phase shift was realized by means of a broadband scheme, that insured phase variation from 0 to 360°. The coincidence-counting rate was measured as a function of the phase shift (time delay). To exclude registration of coincidences due to neutrons arising in the preceding deuteron pulse, the output was passed from the coincidence circuit through a system of gates, the control of which was by means of the pulse from the last dynode of the photomultiplier. The pulse was amplified and after amplitude discrimination it was applied to the circuit. To check the operation of the spectrometer, the 14 Mev line of (DT) neutrons was plotted.

22332

PULSE MODULATORS USING TRANSISTORS AND SWITCHING REACTORS. B. F. C. Cooper and W. J. Payten (C.S.I.R.O., Sydney). Proc. Inst. Radio Engrs. Australia 20, No. 3, 148-52(1959) Mar.

A regenerative circuit is described which uses a power transistor to control the charging of a pulse-forming network through a transformer having a sharply saturating core. The transformer is designed to saturate upon completion of the charging interval, whereupon the stored energy is switched to a load in the form of a steep-fronted pulse. The peak pulse power can be much higher than the peak transistor power, and the pulse rise time is limited only by the core properties and not by the transistor "turn-on" time. One or more additional transfer stages may also be used to compress the pulse duration and increase its peak power still further. (auth)

22333

A SIMPLE METHOD FOR THE STUDY OF PARALYSIS LOSSES OF A COUNTING ASSEMBLY. A. M. Baptista. Rev. fac. ciênc. Univ. Lisboa 2a Sér. B 2, 185-98 (1953).

A simple method for determining the paralysis losses of a counting assembly is described. The method, which is a modification of the multiple source technique, is applied to a study of counting losses in a G. M. counter and scaling circuit assembly. (auth)

22334

SECONDARY ABSOLUTE MEASUREMENT SYSTEM OF BETA-EMITTING RADIONUCLIDES. J. P. Galvao, A. M. Baptista, and F. Sequeira. Rev. fac. ciênc. B, Univ. Lisboa 2a Sér. B 6, 10p.(1957).

An assembly consisting of two end-window G. M. counters where the counting geometry is constant is presented and its fundamental characteristics are studied. The efficiency for a number of radionuclides was determined by comparison with 4π absolute measurements and a calibration curve established as function of the maximum beta energy. (auth)

22335

MILLIMICROSECOND PULSE GENERATOR CAPABLE OF 10 MILLION PULSES PER SECOND. Michiyuki Nakamura (Univ. of California, Berkeley). Rev. Sci. Instr. 30, 778-82(1959) Sept.

A compact, portable pulse generator with output pulses in the millimicrosecond region at high repetition rates is described. The generator has repetition rates of up to 10^7 pulses/sec, pulse rise times of less than 2.5 mμsec, and pulse widths adjustable from 2.5 to 25 mμsec. The output pulse is negative in polarity and is adjustable over an amplitude range of from 0 to 12 v into 125 ohms output impedance. The instrument has provisions for gating, single pulsing, and operation with drive from an external signal source. (auth)

22336

FLIP-COIL TARGET POSITIONER FOR USE WITH ACCELERATORS. Kenneth F. Stone and Robert J. Force (Univ. of California, Berkeley). Rev. Sci. Instr. 30, 787-8(1959) Sept.

A target positioner for use in the accelerating chamber of the Bevatron is described. This positioner has a rise time of 75 msec and equally fast drivedown. The mechanism has proven reliable to 10^6 cy between maintenance periods. (auth)

22337

TECHNIQUE FOR LIQUID PHASE SPECTROPHOTOMETRY AT ELEVATED TEMPERATURES AND PRESSURES. W. C. Waggener (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 30, 788-93(1959) Sept.

A standard Model 14M Cary recording spectrophotometer was equipped with a special cell assembly for studies of the liquid state, particularly of water and radioactive aqueous solutions over a working range of 0 to 250°C and 0 to 1000 psia. The stability and reproducibility of measurements are comparable to those obtainable at room temperature. (auth)

22338

SPECTRUM GENERATOR FOR TESTING OF PULSE-HEIGHT ANALYZERS. J. E. Draper and W. J. Alston, III (Yale Univ., New Haven). Rev. Sci. Instr. 30, 805-9(1959) Sept.

A voltage pulse spectrum generator is described which delivers the following distributions of pulse heights; delta function distribution, uniform distribution, or triangular distribution. The pulses are available at either a regular rate or a random rate. The delta function distribution is calibrated and continuously variable over the ranges 0 to 100 v and 0 to 0.1 v. The duration of the pulses is adjustable over 1 to 4 μsec. (auth)

22339

ANALYSIS OF SINGLE CRYSTAL PULSE-HEIGHT DISTRIBUTIONS. H. M. Childers (American Machine

and Foundry Co., Alexandria, Va.). Rev. Sci. Instr. 30, 816-14(1959) Sept.

A method for analyzing the pulse-height distribution of a single NaI crystal gamma ray spectrometer is presented. The method consists in solving the matrix equation, P = KN(hv), for N(hv), the incident gamma ray spectrum in which P is the pulse-height distribution, and K is the sensitivity matrix of the detector. A procedure for obtaining the elements of K from curves obtainable from the pulse-height distributions produced by a few standard monoenergetic sources has been devised. Experimental results are presented which demonstrate the validity of the method. (auth)

22340

SMALL MAGNETIC FIELD MAPPING PROBES OF THIN SEMICONDUCTING FILMS. John W. Buttrey (Armour Research Foundation, Chicago). Rev. Sci. Instr. 30, 815-17(1959) Sept.

The Hall effect in thin semiconducting films was employed to produce a magnetic field mapping probe of very small active area. Germanium probes having active areas of approximately 10 square microns were found to have a sensitivity of approximately 100 gauss. Results obtained on thin InSb films indicate small area probes of this material should be sensitive to fields smaller than five gauss. (auth)

22341

HIGH-SPEED NONREFRIGERATED ISOLATION TRAPS FOR ULTRA HIGH-VACUUM SYSTEMS. Manfred A. Biondi (Westinghouse Research Labs., Pittsburgh). Rev. Sci. Instr. 30, 831-2(1959) Sept.

A design is given for a nonrefrigerated isolation trap for use in ultra high-vacuum systems. The trap uses either artificial zeolite or activated alumina to retard migration of impurities and hold impurity molecules on contact. With zeolite the trap operated under $\sim 3 \times 10^{-10}$ mm Hg for 75 days; using alumina the trap remained effective for 100 days at $< 1 \times 10^{-10}$ mm Hg. (C.J.G.)

22342

RADIO-FREQUENCY INDUCTION VACUUM FURNACE FOR CLEAN TARGET PREPARATION. R. A. Moore, L. W. Seagondollar, and R. B. Smith (Univ. of Kansas, Lawrence). Rev. Sci. Instr. 30, 837-8(1959) Sept.

A furnace is described which outgasses the backing disk and then evaporates target material into the disk without immediate exposure to air. Many targets can be evaporated from one outgassed wetted crucible. (C.J.G.)

22343

CURRENT REGULATOR FOR "FLOATING" WIRE USED IN MAGNET CALIBRATION. Ivan Lutz and Chester Pike (Univ. of California, Berkeley). Rev. Sci. Instr. 30, 841(1959) Sept.

A current regulator is described for use in magnet calibration by the "floating" wire method. The regulator has a range of 0.25 to 4 amp and 0 to 100 v, with ripple less than 1% peak to peak over the range from 1 to 4 amp. (C.J.G.)

22344

USING RADIOACTIVE ISOTOPES FOR QUALITY CONTROL OF ROLL-STRIP MATERIALS. O. Rozen, L. Sukhova, D. Kheyker, and N. Favorskaya. Stroitel'. Materialy, No. 3, 34-5(1958). (Translated from Referat. Zhur. Elektrotekhn. No. 2, 1959, p.166).

Methods which permit continuously controlling average weight and thickness of moving cardboard or pergamin strip and its density or porosity are examined. The weight was determined by a contactless instrument which depends on absorption of beta-rays by the material; Te^{204} is used as a source, an ionization chamber as a detector. The strip thickness is determined by an inductance primary element. The strip passes between two rolls, one of which is movable. The movable roll is displaced by thickness variations and moves a primary-element core, this results in an output voltage across the primary element which linearly depends on the displacement value. The contactless weight-determining instrument is calibrated by cigarette-paper standards at 220 to 970 g/m^2. A table giving the instrument checking data and a plot of porosity against water absorption in per cent are presented. (TCO)

22345

ELECTRON GUN FOR IONIC SOURCE OF ELECTROMAGNETIC ISOTOPIC SEPARATOR AT THE INSTITUTE "BORIS KIDRIC." Jovan Gucic. Tehnika (Belgrade) 13, No. 3, (1958). (Translated from Referat. Zhur. Fiz. No. 1, 1959, Abstract No. 220).

Investigation of an ion gun with oscillating electron beam for use as the ion source of an electromagnetic isotope separator is discussed. The investigations were carried out in the absence of plasma, for the purpose of establishing the optimum operating conditions of the gun. For this purpose the following parameters were varied: distance between the cathode and the anode, diameter of the helix of the cathode and the diameter of the opening in the anode, filament current, current in the reflecting electrode, current in the anode, and intensity of magnetic field directed along the electron beam.

22346

CONCERNING ONE OF THE FORMS OF THE RADIAL MOTION OF IONS IN A CLOUD CHAMBER. Peter Mohrke (The University, Rostock, East Ger.). Wiss. Z. Univ. Rostock, Math. Naturwiss. Reihe 6, 205-6(1956-57). (Translated from Referat. Zhur. Fiz. No. 3, 1959, Abstract No. 4994.)

A study is made of space charge motion, occurring in a cloud chamber in analogy with the occurrence of a charge in a Geiger-Mueller counter when counting particles. A chamber constructed for this purpose, in which local ionization is produced by means of an electric discharge is described. Under the influence of the clearing electric field, the ions move in a radial direction toward the walls of the chamber. During a fixed instant of time, the field is removed and ordinary expansion and photography takes place. The same method was used to investigate the mobility of ions of various alcohols and inert gases, with which the chamber was filled. It was found that the mobility of positive and negative carriers is practically the same for each filling gas. The mobility of ions changes when the filling gas is changed.

22347

INVESTIGATION OF THE EFFECTIVENESS OF GEIGER-MUELLER COUNTERS FOR GAMMA RAYS. Edwin Lożyński and Wladyslaw Wolter. Zeszyty Nauk. Univ. Jagiel., Ser. Nauk Mat.-Przyrod., Mat., Fiz. Chem. No. 3, 61-9(1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 14919.)

A measurement was made of the efficiency of Geiger-Mueller counters for gamma rays by the coincidence method. The source of gamma rays, radiated in cascade, was Co^{60}. It follows from the measurements that it is necessary to take into account the anisotropy of the

cascade gamma radiation in the coincidence method. A theory is proposed for the measurement of the efficiency of Geiger-Mueller counters for gamma rays when using anisotropic photons emitted in cascade. For a pair of cylindrical brass Geiger-Mueller counters with a wall thickness of 1 mm, the resultant efficiency was $\epsilon = (0.77 \pm 0.03)\%$ at a gamma-ray energy of 1.25 Mev.

22348

SUPPLEMENT TO THE PROCEEDINGS OF THE SEVENTH HOT LABORATORIES AND EQUIPMENT CONFERENCE, PUBLIC AUDITORIUM, CLEVELAND, OHIO, APRIL 7-9, 1959. New York, Engineers Joint Council, American Society Mechanical Engineers, 1959. 24p.

22349

RADIOACTIVITY DECONTAMINATION BY ULTRASONICS. L. M. Behr and W. L. Bryant (Westinghouse Electric Corp., Pittsburgh). 6p. of "Supplement to the Proceedings of the Seventh Hot Laboratories and Equipment Conference." New York, Engineers Joint Council, American Society Mechanical Engineers, 1959.

Two types of transducers, ceramic and magnetostrictive, are compared as to heat range, durability, cooling requirements, efficiency, costs, operation, and applications for use as ultrasonic cleaners. (C.J.G.)

22350

DEVICE FOR REMOTELY SLITTING ALUMINUM TUBES. Paul H. Chismar (E. I. du Pont de Nemours and Co., Aiken, S. C.). 3p. of "Supplement to the Proceedings of the Seventh Hot Laboratories and Equipment Conference." New York, Engineers Joint Council, American Society Mechanical Engineers, 1959.

The design is given for a device which removes distorted, irradiated slugs from aluminum tubes for examination. It has been successfully tested in a "hot" cell. (C.J.G.)

22351

FRENCH MASTER SLAVES. P. Pesenti and G. Chérel (Commisariat à l'Energie Atomique, Saclay, France). 7p. of "Supplement to the Proceedings of the Seventh Hot Laboratories and Equipment Conference." New York, Engineers Joint Council, Americal Society Mechanical Engineers, 1959.

A brief description of the manipulators designed and built at Saclay is given. These prototypes are used in both experimental and other cells. Their principal characteristics are given. (auth)

22352

IMPROVEMENTS RELATING TO NUCLEONIC THICKNESS GAUGES. George Donald Smith and Laurence Edgar Taylor (to W. E. Cole, Ltd.). British Patent 817,371. July 29, 1959.

An adjustment for a thickness gage is described which, by a single potentiometer control, compensates the utilization circuit for variations of the source, source distance, and contamination. The control simultaneously adjusts the gain of the amplifier and balancing potential. (T.R.H.)

22353

IMPROVEMENTS IN OR RELATING TO IONISATION CHAMBERS. Robert Gordon Davis (to E. K. Cole, Ltd.). British Patent 817,481. July 29, 1959.

An aluminum ionization chamber for beta radiation with increased output is described. This is accomplished by painting the inside with lead paint or covering it with lead foil. (T.R.H.)

22354

IMPROVEMENTS IN LEVEL-INDICATING DEVICES FOR CUPOLA FURNACES. (to Strico Gesellschaft fur Metallurgie and Warmetechnik m.b.H.). British Patent 817,628. Aug. 6, 1959.

An indicator for the charge level of a cupola-type blast furnace is described. The instrument measures gas pressure above the charge. (T.R.H.)

22355

IMPROVEMENTS IN OR RELATING TO APPARATUS FOR CONTROLLING THE TEMPERATURE OF HOT SURFACES. Heinz London and Barry Edward Eltham (to United Kingdom Atomic Energy Authority). British Patent 820,405. Sept. 23, 1959.

A device for closely controlling the temperature of a hot surface is described. It consists of a liquid-cooled diaphragm which can be positioned with respect to the hot surface to effect the desired cooling rate. (T.R.H.)

22356

IMPROVED METHOD AND DEVICE FOR THE MEASUREMENT OF IONIZING RADIATION. (to Aktiebolaget Sivo). British Patent 820,441. Sept. 23, 1959.

An improvement of the condenser-chamber method is offered which makes it more sensitive and versatile. The ionization chamber test electrode is kept at a constant negative potential with respect to the grid of the electron tube through a bushing. At the same time a voltage V_0 of constant negative value with respect to one pole of the tube and corresponding to a certain slope of the emission characteristic of the tube is applied to the grid, and the tube is then disconnected from the bushing of the ionizing chamber during a time corresponding to the test time giving the test electrode a definite reference potential. Then the grid of the tube and its surrounding shielding casing are inserted in the bushing without contact between grid and test electrode so that V_0 is impressed on the grid. As the grid and test electrode are pushed together, and the change caused in anode current is measured as a function of the quantity of radiation. (T.R.H.)

22357

IMPROVEMENTS IN OR RELATING TO DEAD-TIME LOSS COMPENSATING CIRCUITS. Jack Bryant (to United Kingdom Atomic Energy Authority). British Patent 821,162. Sept. 30, 1959.

A dead-time loss compensating circuit is described for use with Geiger-Mueller tubes. The circuit generates pulses randomly and a gating arrangement admits those pulses which occur during dead-time to the counter. Thus, random pulses corresponding in mean frequency detector pulse account, on the average, for pulses lost during dead-time. (T.R.H.)

22358

ELECTROMAGNETIC APPARATUS FOR POSITIONING A CONTROL ELEMENT. Joseph Nash Young. British Patent 821,164. Sept. 30, 1959.

A linear electromagnetic motor is described for positioning control elements in a reactor. Gripper coils which fasten to the rod are provided in addition to coils for moving the grippers. To move a control element, the mover coils move the gripper coils to gripping position, gripper coils are energized, and gripper coils (with rod) are moved by mover coils to desired rod position. (T.R.H.)

22359

IMPROVEMENTS IN COMPENSATED IONIZATION CHAMBERS. (to Commissariat à l'Énergie Atomique). British Patent 821,188. Sept. 30, 1959.

An ionization chamber arrangement is described which uses a third chamber the low value of which is adjusted easily, accurately, and independently to improve compensation. The plates of this chamber can be displaced angularly about a central axis to provide the adjustment. (T.R.H.)

22360

IMPROVEMENTS IN OR RELATING TO TRANSISTOR BISTABLE CIRCUITS. Edmund Harry Cooke-Yarborough (to United Kingdom Atomic Energy Authority). British Patent 821,256. Oct. 7, 1959.

A transistor bistable circuit is described which prevents heavy carrier storage and time-loss in switching. It consists of a pair (p-n-p and n-p-n) of junction transistors resistor-connected collector-to-base. One emitter (p-n-p) connected to the positive side and the other emitter (n-p-n) is connected through load to the negative potential of a supply. A diode is connected between the collectors and the insertion of the base-to-collector connections. A resistor is connected from the n-p-n base to the negative potential. (T.R.H.)

22361

IMPROVEMENTS IN NEUTRON DETECTORS. (to Commissariat a l'Energie Atomique). British Patent 821,367. Oct. 7, 1959.

A gas-flow neutron flux measurement instrument is described. Fissionable material of 4 μ thickness or less is exposed to the flux and fission fragments emitted are swept by a gas (air, CO_2, N_2) to a beta or gamma counter. The gas conduits, of Al to prevent electrostatic effects, allow the counter to be remotely located to avoid gamma radiation mixed with the neutrons. (T.R.H.)

22362

HIGH VOLTAGE GENERATOR. A. J. Schwemin (to U. S. Atomic Energy Commission). U. S. Patent 2,878,401. Mar. 17, 1959.

A generator for producing relatively large currents at high voltages is described. In general, the invention comprises a plurality of capacitors connected in series by a plurality of switches alternately disposed with the capacitors. The above-noted circuit is mounted for movement with respect to contact members and switch closure means so that a load device and power supply are connected across successive numbers of capacitors, while the other capacitors are successively charged with the same power supply.

22363

THYRATRON SWITCH. R. Creveling and N. A. Bourgeois, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,883,535. Apr. 21, 1959.

An arrangement for utilizing a thyratron as a noise free switch is described. It has been discovered that the voltage between plate and cathode of a thyratron will oscillate, producing voltage spikes, if the tube carries only a fraction of its maximum rated current. These voltage spikes can produce detrimental effects where the thyratron is used in critical timing circuits. To alleviate this problem the disclosed circuit provides a charged capacitor and a resistor in parallel with the tube and of such value that the maximum current will flow from the capacitor through the thyratron when it is triggered. During this time the signal current is conducted through the tube, before the thyratron voltage starts to oscillate, and the signal current output is free of noise spikes.

22364

GASEOUS SCINTILLATION COUNTER. C. Eggler and C. M. Huddleston (to U. S. Atomic Energy Commission). U. S. Patent 2,884,529. Apr. 28, 1959.

A gaseous excitation counter for detecting the presence and measuring the energy of subatomic particles and electromagnetic radiation is described. The counter includes a gas-tight chamber filled with an elemental gas capable of producing ultra-violet excitation quanta when irradiated with subatomic particles and electromagnetic radiation. The gas has less than one in a thousand parts ultra-violet absorbing contamination. When nuclear radiation is present the ultra-violet light produced by the gas strikes a fluorescent material within the counter, responsive to produce visible excitation quanta, and photo-sensitive counting means detect the visible emission.

22365

ELECTRIC PULSE GENERATOR. Rudolph W. Buntenbach (to U. S. Atomic Energy Commission). U. S. Patent 2,889,465. June 2, 1959.

An electro-optical apparatus is described which produces electric pulses in programmed sequences at times and durations controlled with great accuracy. An oscilloscope CRT is supplied with signals to produce a luminous spot moving in a circle. An opaque mask with slots of variable width transmits light from the spot to a photoelectric transducer. For shorter pulse decay times a CRT screen which emits UV can be used with a UV-transmitting filter and a UV-sensitive photoelectric cell. Pulses are varied by changing masks or by using masks with variable slots. This device may be used in multiple arrangements to produce other pulse arrangements, or it can be used to trigger an electronic pulse generator. (T.R.H.)

22366

A DEVICE FOR CHANGING THE DOSE POWER IN GAMMA-IRRADIATORS. G. M. Frank, A. V. Bibergal', M. M. Korotkov, and O. G. Arakelov. U.S.S.R. Patent 113304. Byull. Izobret., 1958, No. 6.

A device is described that permits smooth (stepless) regulation of the dose power in gamma-irradiators. It is designed in the form of lever-connected turnable axes with pivots and bearings, placed on a cylinder generatrix parallel to the cylinder axis. Each axis is provided with a tubular holder for a linear radiation source and the holder pipe faces the center of a circular generatrix. (TCO)

22367

A METHOD OF DETERMINING THE DISPERSION VALUE OF SUPERFAST PARTICLES IN PHOTOGRAPHIC EMULSIONS. F. G. Lepkhin. U.S.S.R. Patent 113469. Byull. Izobert., 1958, No. 6.

A method is described that measures with a microscope the coordinates of the deviations of the particles from a set straight line. Elimination of the influence of the inaccuracy of the comparison microscope alignment guides on the accuracy of the measurements is achieved by placing the photo-plate with the particle traces on a table with a straight line traced on it parallel with the trace of the particles and moving the base along this straight line under the lenses of the comparison microscope, and determining the dispersion of particles by

the difference of the distances of particle traces from the mentioned straight line. (TCO)

22368

A DEVICE FOR TAKING INTO ACCOUNT THE ALTITUDE OF AN AIRCRAFT DURING AERO-GAMMA-SURVEYING. A. V. Dmitriyev and V. A. Ionov. U.S.S.R. Patent 113680. Byull. Izobret., 1958, No. 6.

A device is described for taking into account the altitude of an aircraft during surveying with an aero-gamma-radiometer; including a functional converter with a potentiometer, the potentiometer slide moving in proportion to the altitude of the aircraft; or, an electron-pulse instrument with the pulses of the aero-gamma-radiometer modulated by the output voltage of a radio altimeter. (TCO)

22369

AN IONIZATION CHAMBER. A. D. Dmitriyev. U.S.S.R. Patent 113964. Byull. Izobret., 1958, No. 6.

An ionization chamber for recording nuclear radiations free of background radiations is described. The chamber consists of a compensating and a sensitive part, high-voltage electrodes and a collecting electrode. The size of the chamber is reduced and the adjustment simplified by hermetically separating the compensating part from the sensitive part. (TCO)

22370

A DIFFUSION CHAMBER FOR DETERMINING THE α- AND β-ACTIVITIES OF RADIOACTIVE PREPARATIONS. V. K. Lyapidevskiy. U.S.S.R. Patent 113969. Byull. Izobret., 1958, No. 6.

A diffusion chamber in which the preparation is placed beyond the condensation zone is described. The equipment has a photoelectric device for recording particle traces consisting of a system of focusing electrodes creating an electric field and directing the α- and β-particles into a specific zone of the sensitive space of the chamber. (TCO)

22371

RADIOACTIVE DENSITY METER. B. Z. Votlokhin. U.S.S.R. Patent 114081. Byull. Izobret., 1958, No. 7.

A radioactive density meter is described for measuring the specific weight of flowing liquids. The instrument has a work chamber and compensating chamber, and an electronic zero-indicator with an electric motor on its output. The motor displaces a compensating screen. To simplify design and improve the reliability of the arrangement, both chambers with the ampule of radio-active substance mounted in the wall between them are encompassed by a rotating shutter with staggered slots; the compensating screen is made in the form of a cylinder pushed into the compensation chamber. (TCO)

ISOTOPES—INDUSTRIAL TECHNOLOGY

22372 AECU-4240

Emerson Radio and Phonograph Corp. Government Electronics Div., Washington, D. C.

A MANAGEMENT EVALUATION OF MASSIVE RADIATION FOR INDUSTRIAL UTILIZATION. Final Report. May 11, 1959. 31p. Contract AT(49-10)-1458. $0.75(OTS).

A survey of development and expected benefits from high-level radiation for use in industrial processing is presented. Industrial applications where large amounts of radiation energy could be used are emphasized. World technology on current and foreseen uses of high-level sources of gamma radiation is examined along with the current and planned uses of large gamma irradiators in the U. S. Technical, economic, and management aspects of high-level radiation uses are considered in relation to the advantages of other energy sources or chemical agents. Recommendations for a development program are included. (J.R.D.)

22373 AECU-4338

Purdue Research Foundation, Lafayette, Ind.

MONTHLY REPORT NO. 4. Includes: BIBLIOGRAPHY OF THE PHARMACEUTICAL APPLICATION OF RADIOISOTOPES AND IONIZING RADIATION. John E. Christian and William F. Bousquet. Sept. 10, 1959. 19p. Contract AT(11-1)-737. $3.30(ph), $2.40(mf) OTS.

A summary of activities during the period are given and a bibliography on pharmaceutical applications of radioisotopes is included. (J.R.D.)

22374 AECU-4362

United States Radium Corp., Bloomsburg, Penna.

DEVELOPMENT OF KRYPTON-85 STATIC ELIMINATION EQUIPMENT. Quarterly Progress Report No. 1 for Period December 1, 1958 to February 28, 1959. F. Palmeri, Jr., H. P. Copeland, and J. G. MacHutchin. Apr. 15, 1959. 30p. Contract AT(30-1)-2306. $4.80 (ph), $2.70(mf) OTS.

Work has been initiated on the development of a static eliminator containing krypton-85 which will eliminate or greatly reduce the build-up of static electricity near operating industrial equipment. A preliminary design of the krypton-85 source and housing unit is presented. Radiation intensities of several Kr^{85} sources were measured and were compared with standard radium foils. (C.W.H.)

22375 AECU-4363

United States Radium Corp., Bloomsburg, Penna.

DEVELOPMENT OF KRYPTON-85 STATIC ELIMINATION EQUIPMENT. Quarterly Progress Report No. 2 for Period March 1, 1959 to May 31, 1959. F. Palmeri, Jr., H. P. Copeland, and J. G. MacHutchin. Aug. 15, 1959. 43p. Contract AT(30-1)-2306. $7.80 (ph), $3.30(mf) OTS.

Progress is reported on the design and construction of Kr^{85} sources and source housings for use in static elimination equipment. A parallel-plate-type ionization chamber was constructed for use in measurement of air ionization at short distances from source surfaces. (For preceding period see AECD-4362.) (C.W.H.)

22376 NP-7917

Brussels. Centre d'Etude de l'Energie Nucléaire.

RADIOISOTOPES ARTIFICIELS PREPARES AU CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE A MOL. (Artificial Radioisotopes Prepared at the Centre d'Etude de l'Energie Nucleaire at Mol.) Aug. 1959. 122p.

A catalog of the isotopes produced at Mol, describing the nuclear properties of the isotope and the form in which it is available, is presented. (J.S.R.)

22377

RADIOISOTOPES IN INDUSTRY TRAINING PROGRAM. Volume 1. John P. Danforth and Robert P. Stapp, eds. Flint, Mich., General Motors Institute, 1959. 739p. $5.00(OTS).

A compilation of training material designed to teach professional industrial personnel in the use of radioisotopes is presented. Individual lectures are contained on laboratory design, routine operating procedures, safety, industrial hygiene, radiation medical problems, public relations, isotope procedure, equipment decontamination, waste disposal, and government regulations regarding the use, transportation, and storage of by-product materials. Necessary reference material is listed and chart material, handouts, and sample data sheets for various operations involving radioisotopes are included to prepare the trainees so that they can design and operate independent isotope laboratories within their own organizations. (C.J.G.)

22378

RADIOACTIVE TRACER. (to Esso Research and Engineering Co.). British Patent 820,584. Sept. 23, 1959.

A method of preparation of Au^{198} layers on subdivided solids is described. In one example microspheroidal cracking catalyst (alumina and silica) particles 20 to 40 μ were mixed in $AuCl_3$ and oxalic acid until the powder was wet. This mixture was baked at 250°F to reduce and then at 1000°F to dry the powder. Shaking and sifting removed surface Au, then the Au-plated powder was irradiated in a reactor to produce Au^{198}. This form of radiogold is useful in studying catalysis, and similar forms are useful in studying mixing in fluid beds, lubrication, leaks, and other things. (T.R.H.)

METALLURGY AND CERAMICS

22379 AECU-4255

Stevens Inst. of Tech., Hoboken, N. J. Powder Metallurgy Lab.

SLIP CASTING OF NUCLEAR FUEL ELEMENTS. Gregory J. Comstock, Frances H. Clark, Edward H. Baron, and Edmund B. Wilson. July 17, 1959. 19p. Contract AT(30-1)-2258. $0.75(OTS).

A process was developed for fabricating thin dispersion fuel element cross sections entirely from powder by variations of the slip casting process. Elements were made 2 in. wide × 4 in. long having a 0.020 in. fuel core of 75% (wt. %) type 316 stainless steel and 25% (wt. %) uranium dioxide (UO_2) clad on each side with 0.005-in. of type 316 stainless steel. Microstructural examination indicated no fragmentation of the UO_2, solid density cladding, uniform and fine grain size of the stainless steel matrix and cladding, and no discontinuity at the cladding core interface even after drastic cold forming. Tensile properties of the annealed plate, as measured on 1 in. gage length, stamped specimens, were 55,800 psi ultimate stress, 27,600 psi (0.2% offset) yield stress and 19.4% elongation at room temperature. Samples of plates were successfully cold formed through as low as 0.005-in. radius of bend (t/r of 8). Cladding and matrix behaved integrally in tensile and cold forming tests. (auth)

22380 AECU-4335

Denver. Univ. Denver Research Inst.

STUDY OF FACTORS INFLUENCING DUCTILITY OF IRON–ALUMINUM ALLOYS. Monthly Letter Report No. 5 for March 15, 1959 to March 15, 1960. George Rauscher, Frank C. Perkins, and Joseph F. Nachman. Sept. 11, 1959. 12p. Contract AT(11-1)-742. $3.30 (ph), $2.40(mf) OTS.

Order-disorder structures of Fe–Al alloys were studied and data on the Miller indices for the diffracting planes of the lattices in the random distribution of FeAl, and Fe_3Al structures are given. X-ray data for mechanical properties correlation with order-disorder transformation in alloys are tabulated listing the reflecting planes for the various super lattice structures, interplanar spacings, and Bragg angles. Also included are data on x-ray-crystal analyses as function of various heat treatments, and tabulated data on tensile testing. (J.R.D.)

22381 AECU-4346

Pennsylvania. Univ., Philadelphia.

THERMODYNAMIC PROPERTIES OF CARBIDES AT HIGH TEMPERATURES. Annual Report and Renewal Proposal. S. Fujishiro and N. A. Gokcen. Sept. 22, 1959. 8p. $1.80(ph), $1.80(mf) OTS.

Equilibrium vapor pressures of the carbides of titanium, zirconium, uranium, and chromium are being determined by means of graphite Knudsen effusion cells. The weight of effusate is determined by weighing and, whenever practical, by the alpha counting method. Experimental data are given for TiC at 2482°K. (auth)

22382 AECU-4364

Materials Research Corp., Yonkers, N. Y.

A FUNDAMENTAL STUDY OF GRAIN BOUNDARY PHENOMENA IN CERAMIC MATERIALS. Status Report No. 1 for the Period June 15, 1958 to March 1, 1959. 17p. Contract AT(30-1)-2178. $3.30(ph), $2.40(mf) OTS.

The role of the grain boundary in the creep process was examined by direct observation of grain boundary sliding in ceramic bi-crystals. Specimens of MgO, Al_2O_3, and NaCl were tested up to 1100°C. The alumina and magnesia bi-crystals exhibited no grain boundary sliding at these temperatures, while NaCl crystals manifested marked sliding. Internal friction studies revealed the presence of grain boundary stress relaxation peaks in the spectra of magnesia and alumina at about 1000°C. Etchpit studies were also conducted with particular emphasis on MgO. (J.R.D.)

22383 ARF-2149-4

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE MECHANISM OF STRENGTHENING IN METALS CONTAINING AN OXIDE DISPERSION. Final Report [for] July 1, 1958 to July 1, 1959. Robert L. Hodson, Robert H. Read, and Arthur G. Metcalfe. July 27, 1959. 43p. DA Project 5B99-01-004. Contract DA-11-022-ORD-2770. (OOR-2037.1).

Investigations were made in areas fundamental to dispersion strengthening theory. A study of the effects of bonding between particulate oxide dispersion and matrix has strongly indicated that dispersion efficiency is dependent upon the existence of the bond. In the evaluation of the disperse phase contribution, the effects of matrix grain size and solid-solution (oxygen) hardening were taken into account by evaluation of these as individual contributions. Investigations were made with the intent of showing whether holes (porosity) can contribute a dispersion hardening factor to an alloy. (auth)

22384 BMI-890

Battelle Memorial Inst., Columbus, Ohio.

SURVEY OF MATERIALS FOR SUPERCRITICAL-WATER REACTOR. Murray C. Udy and Francis W. Boulger. Nov. 27, 1953. Decl. Aug. 10, 1959. 52p. Contract W-7405-eng-92. $7.80(ph), $3.30(mf) OTS.

A survey was conducted in the search for materials

potentially useful in the supercritical-water reactor. Tensile strength, 0.2% offset yield strength, 1000 hr rupture strength, endurance strength, tensile elongation, Young's modulus, coefficient of thermal expansion, and coefficient of thermal conductivity are presented as a function of temperature. Nominal compositions, usual heat treatment, density, and thermal-neutron-absorption cross sections are tabulated. Materials covered include SAE 4340, Timken 17-22-A, 17-22-A S, and 17-22-A V, Types 310, 347, 410, and Crucible 422 stainless steels, Jessop H46, Rex 448, Armco 17-4 PH and 17-7 PH, Stainless W, Allegheny A-286, Tinidur, Discaloy, Nimonic 75, 80, and 80A, Hastelloys C and X, Inconel X, Copper Alloy V2B, and titanium alloys RC 130B, RC A110AT, Ti155AX, and Ti–3 Mn complex. (auth)

22385 BMI-1371
Battelle Memorial Inst., Columbus, Ohio.
SPRAY DEPOSITION OF CALCIUM METAL ON NICKEL OR INCONEL. Albert F. Haskins and Robert M. Evans. Aug. 24, 1959. 13p. Contract W-7405-eng-92. $0.50(OTS).

The inert-gas arc-spray method was studied in an effort to develop a continuous process for coating metals with calcium. Duplex electrode arc-spray equipment was used throughout the investigation. While the process appeared feasible, vapors produced during arc spraying and generally poor adhesion of the calcium to the base metal were considered the major deterrents to the process. Other methods studied or investigated disclosed that the plasma-jet process improved the bonding between calcium and base metal, but that further research would be necessary to effect uniform coatings of calcium. The present state in Europe of arc-metal spraying was reviewed. No information on specific techniques was located in the literature. (auth)

22386 CARDE-TM-192/58
Canada. Armament Research and Development Establishment, Valcartier, Que.
THE MECHANICAL PROPERTIES OF METALS UNDER DYNAMIC LOADING. H. P. Tardif and William Erickson. Apr. 2, 1958. 21p.

A survey of the dynamic properties of metals published to date is presented. Properties have been found for mild steel, medium carbon steel, quenched and tempered alloy steels, aluminum alloys, and a few other metals. Although the yield stress of mild steel may be increased during dynamic deformation by as much as 2 or 3 times its static value, the increase in most other metals is much smaller, being of the order of approximately of 0 to 30%. While it is unlikely that general use of dynamic properties will be made by designers, this use may be warranted in certain specific applications, one of them possibly being the design of certain types of projectiles as these are used only once and under high rates of stress application. The information obtained from dynamic tests moreover, even if not used in practice, may be an important indication of the increase in the safety factor of the structure designed for high stress rate application. (auth)

22387 CF-54-12-26
Oak Ridge National Lab., Tenn.
RESULTS OF STATIC CORROSION TESTS ON VARIOUS NICKEL-BASE BRAZING ALLOYS USED TO FABRICATE 304 STAINLESS STEEL T-JOINTS. JOINTS TESTED IN SODIUM AND FLUORIDE #44 ($NaF-ZrF_4-UF_4$) FOR 100 HOURS AT 1500°F. E. E. Hoffman. Dec. 3, 1954. Decl. June 8, 1959. 3p. Contract W-7405-eng-26. $1.80(ph), $1.80(mf) OTS.

The results of corrosion tests on nickel-base brazing alloys indicated that all the alloys tested had good resistance to attack by fused chloride. The chromium–nickel–phosphorus system showed good resistance to attack by both fused fluoride and sodium. (J.E.D.)

22388 CF-59-8-135
Oak Ridge National Lab., Tenn.
FURTHER EVALUATION OF CHECK VALVE MATERIAL FOR THE HOMOGENEOUS REACTOR PROGRAM. R. Blumberg. Aug. 4, 1959. 14p. $3.30(ph), $2.40(mf) OTS.

A number of materials were tested to improve check valve trim material selection for aqueous homogeneous system fluids. Previous recommendations of Stellite 3 and 17-4 PH stainless steel were found valid for uranyl sulfate and distilled water service, respectively. Aluminum oxide and boron carbide were found applicable to ThO_2 slurry service. Test runs demonstrate that check valve hardware is now available to pump slurry for at least 3 months of continuous duty. (auth)

22389 CTR-343
Office of Technical Services, Washington, D. C.
POWDER METALLURGY—1929–1958. Catalog of Technical Reports. 12p. $0.10(OTS).

22390 CTR-366
Office of Technical Services, Washington, D. C.
URANIUM—PART II, ALLOYS AND COMPOUNDS—1936–1958. Catalog of Technical Reports. 14p. $0.10(OTS).

22391 DMIC-117
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
TITANIUM ALLOYS FOR HIGH-TEMPERATURE USE STRENGTHENED BY FIBERS OR DISPERSED PARTICLES. J. W. Holladay. Aug. 31, 1959. 78p. (PB-151073). Contract AF18(600)-1375.

Available data are reviewed on heterogeneous structures of titanium in which the titanium matrix is reinforced by a dispersion of metal fibers or particles. Fiber reinforcement offers promise for improving the short-time strength and modulus of elasticity in the temperature range of 1000 to 1400°F. It has been demonstrated that titanium can be strengthened by dispersion hardening and by fiber reinforcement, although the best conditions have not yet been fully established. (auth)

22392 DMIC-Memo-33
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
TITANIUM FABRICATION AND RELIABILITY PROBLEMS IN AIRCRAFT. W. Stuart Lyman and C. T. Olofson. Sept. 4, 1959. 32p.

A brief summary of the fabrication and reliability problems associated with titanium in aircraft production is presented. (J.E.D.)

22393 HW-60910
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
END CLOSURE FOR PLUTONIUM BEARING ZIRCALOY-2-CLAD FUEL ELEMENTS. L. C. Lemon. June 30, 1959. 13p. Contract W-31-109-Eng-52. $0.50(OTS).

An investigation was initiated to evaluate the fillet head weld (Figure 1) on both plutonium aluminum alloy

and plutonium oxide bearing, Zircaloy-2-clad fuel elements, using the tungsten inert gas process. The integrity of this weld has been subjected to a series of destructive tests including fatigue, torsion, tensile and autoclave, without weld failure. Results show no porosity or lack of pentration in over 800 welds (Figure 2 shows the welded joint). This joint design and welding procedure has been accepted for fabrication of plutonium-bearing Zircaloy-2-clad fuel elements for the Plutonium Recycle Program at Hanford. (auth)

22394 HW-61583

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PRECISION DUPLICATION OF METAL PARTS IN TOOLING PLASTICS. J. H. Kleinpeter. Aug. 18, 1959. 6p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

Experiments were conducted to determine the accuracy with which precision parts can be duplicated using castable tooling plastic as a test shape to be reproduced. The faithfulness of the reproduction is about as precise as the measuring methods. Procedure and apparatus are described, and data are tabulated. (J.R.D.)

22395 HW-61820

Washington. Univ., Seattle.

A REPORT OF RESULTS OF TESTS ON IMPERVIOUS GRAPHITE, AND DISCUSSIONS BY: L. N. Johanson, Robert J. Campbell, Edward E. Mueller. Mar. 13, 1958. 47p. For General Electric Co. Hanford Atomic Products Operation. $7.80(ph), $3.30(mf) OTS.

Results of experiments on impervious graphite are summarized. Burst tests of a thick-walled cylinder indicated a transverse tensile strength of about 1900 psig. Diffusion of He and CO_2 through Graph-i-tite G is much greater than would be desirable if the tube is to be used as a confining vessel. The effect of pressure on diffusion was appreciable. Some difficulties were encountered in the machining of the specimens for testing. A pronounced resilience caused a variation of from three to five thousandths of an inch over a six-inch span. (W.L.H.)

22396 KAPL-M-HOS-8

Knolls Atomic Power Lab., Schenectady, N. Y.

CHROMIUM ELECTROPLATES FOR CORROSION PROTECTION OF STRESSED AISI 410 IN HIGH TEMPERATURE, HIGH PURITY WATER. Henry Suss. Sept. 4, 1959. 29p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

The use of chromium plates for protection of AISI 410 against stress corrosion cracking has given anomalous results. The coating either offered protection under conditions which produced failure in unplated material or caused accelerated failures under conditions in which unplated material did not fail. Factors which may have contributed to the anomalous results are discussed. Introduction of oxygen into 300°F water systems caused accelerated stress corrosion failures, especially for the chromium-plated samples, with applied stresses as low as 60,000 psi. From present available information, chromium deposits are not recommended for corrosion protection of AISI 410 materials susceptible to stress corrosion and/or intergranular attack. (auth)

22397 KY-314

Union Carbide Nuclear Co. Paducah Plant, Ky.

UTILIZING TWO WELDING PROCESSES IN TANDEM. E. C. Alexander and J. D. Nicol. Sept. 30, 1959. 11p. Contract W-7405-eng-26. $0.50(OTS).

The joint design used when replacing the head of a number of large tanks permits the use of two welding processes in tandem. The two processes are a semiautomatic shielded arc magnetic flux process and a submerged arc process. Elapsed time is reduced by 50% when the two processes are used in tandem. (auth)

22398 KY-315

Union Carbide Nuclear Co. Paducah Plant, Ky.

APPLICATIONS OF CUTTING AND WELDING PROCESSES. E. C. Alexander and J. D. Nicol. Oct. 9, 1959. 13p. Contract W-7405-eng-26. $0.50(OTS).

Copper clad steel sheets, used in the fabrication of tank shells, were economically cut to size by utilizing a tungsten inert gas cutting process. This process eliminates the need of chipping the copper away from the cutting line prior to the cutting operation. The welding time required for making a root pass in steel pipe was reduced up to 50% when a semiautomatic short arc process, using a metallic inert gas torch, was adapted for this work. (auth)

22399 NAA-SR-2570

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

BEHAVIOR OF STRUCTURAL MATERIALS EXPOSED TO AN ORGANIC MODERATED REACTOR ENVIRONMENT. N. J. Gioseffi and H. E. Kline. Oct. 1, 1959. 44p. Contract AT-11-1-GEN-8. $1.25(OTS).

The behavior of various structural materials, including Type 1020 carbon steel, Types 304 and 410 stainless steel, Type 4130 alloy steel, aluminum, and magnesium, in an organic moderated and cooled reactor have been determined. In-pile specimens examined were exposed to measured integrated neutron fluxes in the order of 9.0×10^{19} nvt thermal and 2.8×10^{20} nvt fast (energies > 1 Mev). Exposure time was eight months, during which the reactor achieved 544 Mwd of operation. A polyphenyl, composed of ortho-, meta-, and paraterphenyls and diphenyl, with various amounts of high boiler compounds, served as the coolant. Nominal bulk coolant temperature in the core was 600°F. Out-of-pile specimens were exposed for 13 months in a bypass line of the reactor. Results of the examination indicated the environment to be noncorrosive in nature. With the exception of magnesium, the corrosion resistance of all materials tested was considered good to excellent. The environment caused neither stress corrosion nor accelerated attack of bimetal couples. Irradiation had no significant effect on the corrosion resistance of the materials tested. Mechanical property changes after irradiation were the same as those expected in materials irradiated without the polyphenyl environment. These changes were attributed to radiation damage. Ferritic grade steels were most affected; however, the magnitude of these changes is not considered serious. Slight changes in the postexposure mechanical properties of out-of-pile specimens were concluded to be thermally induced. (auth)

22400 NAA-SR-4155

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

VIBRATORY COMPACTION AND SWAGING OF URANIUM DIOXIDE TO HIGH DENSITY. B. A. Webb. Oct. 1, 1959. 19p. Contract AT-11-1-GEN-8. $0.50 (OTS).

Techniques for the fabrication of ceramic fuel ele-

ments by vibratory compaction and swaging of powders inside a metal tube were investigated. Vibratory packing of powders containing three particle size fractions resulted in a maximum density of 9 g/cm^3, or 82.2% of the theoretical density. It was possible to increase the packed density to 9.9 g/cm^3, or approximately 90% of theoretical, by cold swaging, and to 10.5 g/cm^3, or more than 95% of theoretical, by warm swaging at 600°C. Fabrication of spherical UO_2 shot was investigated. Shot of the desired particle size ranges was produced with densities ranging from 10.2 to 10.5 g/cm^3, or 93 to 96% of theoretical density. (auth)

22401 NAA-SR-Memo-3662

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

NICKEL BONDING OF ALUMINUM CLAD OMR METALLIC CORE FUELS, CURRENT STATUS. G. V. Alm. Mar. 20, 1959. 13p. $3.30(ph), $2.40(mf) OTS.

Current information regarding the Al–Ni–U bond is reviewed and work being done to evaluate the bond as related to OMR fuels is discussed. The principal area of uncertainty regarding the Al–Ni–U solid state bond has been whether or not it will remain intact and/or effectual under long term OMR operating conditions. Temperature and time exposures are given for consumption of 0.5 and 1.0 mil thicknesses of free nickel. (W.D.M.)

22402 NASA-TN-D-75

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

DUCTILE CERAMICS. I FACTORS AFFECTING THE PLASTICITY OF SODIUM CHLORIDE, LITHIUM FLUORIDE, AND MAGNESIUM OXIDE SINGLE CRYSTALS. Carl A. Stearns, Ann E. Pack, and Robert A. Lad. Oct. 1959. 44p. OTS.

A study was made of the influence on the behavior in bending and compression of treatments such as water-polishing, varying cleavage rate, annealing, quenching, x irradiation, surface coating, and aging. Etchpit studies were made of the modifications in dislocation concentration and distribution. The load-deflection curves exhibit an initial anelastic region which can be modified by specimen treatment. The expansion of cleaved-in dislocations and their subsequent contraction upon removal of stress is suggested as the source of this anelastic deformation. The effects of the above treatments on load and deflection at fracture are examined in terms of crack nucleation at the surface. (auth)

22403 NASA-TN-D-76

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

DUCTILE CERAMICS. II. INTRODUCTORY STUDY OF DUCTILITY IN POLYCRYSTALLINE SODIUM CHLORIDE AND MAGNESIUM OXIDE. Charles E. May, Hubert H. Grimes, and Robert A. Lad. Oct. 1959. 23p. OTS.

Polycrystalline sodium chloride was made to exhibit ductility in bend tests by a vapor deposition of silver on each crystallite in the specimen. The silver apparently acts as a specific surface-active agent. Other treatments, such as a stearic acid coating, were not as successful as that using silver. The difficulties involved in extending this study to polycrystalline magnesium oxide were also investigated. (auth)

22404 NASA-TN-D-181

National Bureau of Standards, Washington, D. C.

INVESTIGATIONS OF CREEP BEHAVIOR OF STRUCTURAL JOINTS UNDER CYCLIC LOADS AND TEMPERATURES. Leonard Mordfin, Nixon Halsey, and Gary E. Greene. Oct. 1959. 38p. $1.00(OTS).

Eighty-two structural joint specimens were tested to evaluate the effects of cyclic loads and cyclic temperatures on creep and rupture. The specimens included riveted joints of 2024-T3 clad aluminum alloy, and riveted and spot-welded joints of 17-7 PH (TH 1050) stainless steel. The results of these tests show a wide variance but indicate certain trends which permit the estimation of the cyclic creep behavior of joints. (auth)

22405 NAVORD-5880

Naval Ordnance Test Station, Inyokern (China Lake), Calif.

THE EXPLOSIVE PRESS AS A RESEARCH TOOL IN MATERIAL BEHAVIOR AND FORMING. Edward W. LaRocca and John Pearson. May 12, 1958. 18p. (NOTS-2019; PB-151844). $0.50(OTS).

Small, explosively activated presses were used as research tools in the study of the behavior of powdered materials under impulsive loads. Both single- and double-action presses provided positive retention of the test specimen. The double-action press, which is of sandwich-type construction, uses two explosive charges fired simultaneously to drive two opposed pistons together into a central steel cylinder in which the specimen material has been placed. Estimates of the pressures which can be obtained are on the order of several million pounds per square inch. By modifying the working faces of the pistons, materials can be formed into various shapes by the action of the press. Operation of these presses and their application to the study of several materials are described. (auth)

22406 NDA-2112-1

Nuclear Development Corp. of America, White Plains, N. Y.

THE PREPARATION AND PROPERTIES OF DISPERSION HARDENED URANIUM POWDER PRODUCTS. Quarterly Technical Report for period ending Mar. 31, 1959. W. Arbiter. Apr. 15, 1959. 33p. Contract AT(30-1)-2303. $6.30(ph), $3.00(mf) OTS.

Various aspects of the planned program for the investigation of dispersion strengthening as a means of improving the stability of uranium in radiation and thermal cycling environments are covered. Literature dealing with uranium-gas reactions, the powder metallurgy of uranium, and the principles of dispersion hardening has been surveyed and is summarized. Equipment to be used in the investigation has been purchased, fabricated, and assembled. The equipment is described and the general approach to the problem is outlined. (auth)

22407 NMI-1210

Nuclear Metals, Inc., Concord, Mass.

PRECIPITATION PROCESSES IN COPPER-RICH COPPER–IRON ALLOYS. A. Boltax. Aug. 28, 1959. 44p. Contract AT(30-1)-1565. $1.25(OTS).

A technique is described for studying the precipitation processes in copper-iron alloys by means of electrical resistivity and magnetic measurements. On slowly cooling alloys of 3.25 wt. % iron from 1050°C to room temperature, two distinct stages in the precipitation process were detected. Above 850°C, a coarse f.c.c. precipitate is formed which transforms to b.c.c. form below 850°C, whereas below 850°C the precipitation reaction involves the formation of fine f.c.c. coherent particles which are stable at room temperature.

Aging of quenched alloys containing 1.7 wt. % iron in the temperature range from 200 to 700°C results in the formation of a non-ferromagnetic precipitate. The kinetics of this reaction can be described by a time exponent in the rate equation of 0.28 ± 0.03 and an activation energy of 34 ± 5 kilocalories per mole. Precipitation during aging of the quenched samples appears to be consistent with the concept of nucleation of precipitate particles at dislocation loops formed by the clustering of quenched-in vacancies. (auth)

22408 NMI-1215
Nuclear Metals, Inc., Concord, Mass.
FUNDAMENTAL RESEARCH AND DEVELOPMENT IN METALLURGY. Annual Report to the Research Division for the period July 1957 to June 1958. Sept. 1, 1959. 27p. Contract AT(30-1)-1565. $0.75(OTS).

In earlier work it was found that solubilities of other metals in Hg, Tl, Pb, and Bi are related to the locations of the solutes in the periodic table. The survey was extended to include Cd, In, Sn, and Sb. Data on these solubilities are presented along with similar data for Al, Zn, and Ga. Research in deformation modes of Zr is reported. A summary of crystal growing techniques, results of room temperature deformation tests, and information on twin elements are summarized in included abstracts and tables. Studies of Cu–Fe precipitation hardening alloys under neutron irradiation were completed. Abstracts of topical reports describing this work are also included. (J.R.D.)

22409 NMI-1221
Nuclear Metals, Inc., Concord, Mass.
DEFORMATION MODES OF ZIRCONIUM AT 77°K, 300°K, 575°K, and 1075°K. E. J. Rapperport and C. S. Hartley. Aug. 12, 1959. 38p. Contract AT(30-1)-1565. $1.25(OTS).

A study has been made of the deformation processes active in zirconium crystals deformed at 77, 300, 575, and 1075°K. The specimens were large-grained samples of relatively high purity and wide orientation distribution. The only slip system observed at any of the temperatures was of the form $(10\bar{1}0)\ [\bar{1}2\bar{1}0]$ with a critical resolved shear stress of about 1.0 kg/mm^2 in tension at 77°K, 0.65 kg/mm^2 in compression at 300°K, 0.20 kg/mm^2 in tension at 575°K, and 0.02 kg/mm^2 in tension at 1075°K. The slip planes were found by the usual two-trace techniques and the slip direction found from a detailed analysis of Laue spot asterism which is appended. The active twin planes were $\{10\bar{1}2\}$, $\{11\bar{2}1\}$, $\{11\bar{2}2\}$, and $\{11\bar{2}3\}$ with varying frequencies at the different test temperatures. The most active at all temperatures was $\{11\bar{2}1\}$, with $\{11\bar{2}2\}$, $\{11\bar{2}3\}$, and $\{10\bar{1}2\}$ twins unobserved at 1075°K. The absolute thicknesses of the twin families at each temperature were measured and compared with the twinning shears for the contributing families to yield deviations from the generalization that the twinning shear is inversely related to the twin breadth. (auth)

22410 NMI-4703
Nuclear Metals, Inc., Cambridge, Mass.
ZIRCALOY-CLAD URANIUM FUEL ELEMENTS. Fabrication Report To Hanford Atomic Products Operation. H. F. Sawyer. Mar. 7, 1958. 15p. Contract AT(30-1)-1565. $3.30(ph), $2.40(mf) OTS.

The properties of extruded and Zircaloy-clad uranium rods, net uranium in the element, core length, clad thickness, Zircaloy–Zircaloy bond, heat treatment, preparation, and fabrication data are briefly described. (J.E.D.)

22411 NMI-4918
Nuclear Metals, Inc., Concord, Mass.
URANIUM ROD COEXTRUDED WITH ZIRCONIUM ALLOY CLAD. H. F. Sawyer. Mar. 19, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

Specifications are given for the coextrusion of a U rod clad with Zr alloy. Specifications are also given for the fabrication of a Zr–2 wt. % Al–5 wt. % Mo strip. (W.L.H.)

22412 NP-7910
Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.
THEORY OF D FOR SELF-DIFFUSION IN SOLID METALS. G. M. Pound, W. R. Bitler, and H. W. Paxton. [1959]. 17p. Contract Nonr-760(08).

The kinetics of diffusion in solids is treated in terms of statistical mechanics from the point of view of absolute rate theory. An approximate description of the activated state leads to the conclusion that in the two degrees of freedom orthogonal to the jump direction only the lower vibrational energy levels are occupied. This circumstance gives rise to a negative contribution to the experimental entropy of activation for diffusion in solids which is negligible for the vacancy mechanism but very appreciable for the ring mechanism. It is suggested that a low D_0, perhaps of the order of 10^{-3} cm^2/sec, is an experimental criterion for 4-atom ring diffusion and that the self-diffusion in pure chromium and uranium (bcc) occurs by this mechanism. Further, a low Arrhenius frequency factor is predicted for all processes in solids which require simultaneous jump of n atoms, e.g., in the thermally activated movement of dislocation loops. (auth)

22413 NP-7934
Battelle Memorial Inst., Columbus, Ohio.
FUNDAMENTAL STUDIES ON THE MECHANISM OF ULTRASONIC WELDING. Progress Report. W. J. Lewis, J. N. Antonevich, R. E. Monroe, and P. J. Rieppel. Sept. 15, 1959. 16p. Project No. 7351. Contract AF33(616), 6268.

Studies were undertaken to determine the minimum energy required to weld aluminum, copper, iron, nickel, and titanium. The minimum energy required for welding is being obtained from shear-force and displacement measurements. The shear forces developed during ultrasonic welding were measured successfully by using an accelerometer mounted at the displacement node of the welding tip. Studies made to measure ultrasonic shear forces by attaching strain gages to the section between the welding tip and transducer were not successful because of the short fatigue life of the gages. A plate-cylinder welding system is being used because the mechanics under loads normal and tangential to its contact area have been developed. Knowing the minimum energy required for welding and the stresses involved at the weld interface, it is believed that the applicability and limitations of the ultrasonic-welding process can be determined. Studies were continued on the effect of material variables on ultrasonic welding. So far, it has been found that the weld strength of aluminum in the as-welded condition increases with degree of cold work and is the same after a postweld anneal. The weld strengths of all the aluminum samples, regardless of the degree of cold work, are the same as that of as-welded 1100-O aluminum. The weldability of aluminum does not appear to be affected by grain size. Work also is being done on the effect of yield strength on weldability. (auth)

22414 NP-7940
New York Univ., New York.
FIFTH TITANIUM METALLURGY CONFERENCE. [1959]. 92p.

Papers presented include: welding of Ti and Ti alloys; extrusion of Al–Mo–Ti alloys; physical and mechanical properties of B 120 VCA; phase equilibria and kinetics for B 120 VCA; TTT characteristics of the four Ti sheet rolling program alloys; behavior of spot and fusion welded Ti–V–Cr–Al and Ti–Al–Fe–Cr; Ti alloys for solid fuel rocket cases; radiant quartz lamp brazing of Ti honeycomb structure; cold extrusion of Ti; effects of fabrication on properties of Ti–Al–V–Sn–Fe–Cu alloy; physical and mechanical metallurgy in the fabrication of Ti sheet alloy; thermal stability of Al–Ti alloys; electrochemical and corrosion behavior of Ti and Ti alloys; Ti alloys for use at 1200 to 1800°F; and high-temperature Ti alloy development. (W.L.H.)

22415 NRL-5236
Naval Research Lab., Washington, D. C.
EFFECT UPON SHOCK SPECTRA OF THE DYNAMIC REACTION OF STRUCTURES. George J. O'Hara. Oct. 9, 1958. 20p. Project NS 711-105.

Attempts to use fiducial limit curves of a set of classes of shock spectra as a basis for the design of structures have shown that the design spectra obtained by the combinatorial analysis of many shock spectra tend to be overconservative. This interim report presents a possible explanation for this. It exhibits some experimental evidence to show that the values of interest in a shock spectrum plot tend to lie in the valleys of that plot and not upon the peaks, whereas fiducial limit curves are controlled by the peaks of the individual shock spectra. (auth)

22416 NRL-5347
Naval Research Lab., Washington, D. C.
SIMPLE LABORATORY BULGE TESTS FOR SHEET-METAL FRACTURE-TRANSITION STUDIES AND FOR WELDMENT-PERFORMANCE EVALUATION. P. P. Puzak and J. Stoop. May 27, 1959. 18p. Project Nos. NA-585-001 and NR-512-000.

Procedures and details are described for a simple and inexpensive fracture test developed for making fracture-transition studies and weldment-performance evaluations of high-strength sheet materials. The test is based on the use of rubber as a noncompressible fluid medium for transmitting the force of an impact blow to 6-in.-square specimens. The test is conducted in uniquely designed equipment void of complicated fixtures or gripping devices. Thus, after only brief instructions, skilled or semi-skilled technicians can evaluate rapidly numerous samples over a wide range of testing temperatures. Initial fracture-transition results are given for several steels and correlated with results obtained for these steels in other tests. The most significant use intended for the new test procedure is that of demonstrating potentially weak or brittle paths of failure in a weld assembly. The studies will be aimed at establishing the welding procedures, techniques, and materials required to insure trouble-free service in welded high-strength sheetmetal structures. (auth)

22417 NRL-5367
Naval Research Lab., Washington, D. C.
CHARPY-V TRANSITION TEMPERATURES OF FERRITIC IRON ALLOYS. PART II. IRON–CHROMIUM AND IRON–CHROMIUM–ALUMINUM. J. E. Srawley. Aug. 24, 1959. 18p.

The Charpy-V mid-energy transition temperatures of a series of iron–chromium alloys containing up to 24.3% chromium, and of three series of iron–chromium–aluminum alloys containing up to 25% chromium and 6% aluminum, have been determined for several conditions of mechanical working and heat treatment. The fracture mode of specimens broken below the transition temperature was invariably transgranular. The transition temperatures of the iron–chromium alloys decreased with increasing chromium content when the alloys had been quenched from 1650°F, and increased with increasing chromium content when the alloys were slowly cooled from 1650°F. The effects are not readily explained by the known embrittling mechanisms: 885°F embrittlement and sigma-phase embrittlement. Alloys containing about 0.5% aluminum had significantly lower transition temperatures than corresponding alloys without aluminum. Alloys containing about 5% aluminum had higher transition temperatures than those without aluminum. Manganese contents of up to 12.8% appeared to have no beneficial effect on the transition temperatures of the iron–chromium–aluminum alloys, and titanium contents up to 1.92% raised the transition temperature. (auth)

22418 NYO-2321
Southwest Research Inst., San Antonio.
CYCLIC PRESSURE TESTS OF LARGE SIZE PRESSURE VESSELS. Progress Report No. 10 [for] July 15, 1959 to August 15, 1959. M. M. Lemcoe. Aug. 15, 1959. 31p. Project No. 773-2. Contract AT(30-1)-2140. $4.80(ph), $2.70(mf) OTS.

An investigation of the plastic fatigue strength of large-size pressure vessels fabricated from A-201 steel is presented. The fatigue testing was carried out at a cyclic peak pressure selected to cause failure in approximately 20,000 cycles. (J.E.D.)

22419 ORNL-2757
Oak Ridge National Lab., Tenn.
BERYLLIUM THERMAL-CYCLING EXPERIMENT. W. H. Kelley, D. L. Platus, and J. R. Tallackson. Sept. 24, 1959. 20p. Contract W-7405-eng-26. $0.75 (OTS).

Severe thermal stresses were anticipated in the beryllium reflector of the Aircraft Reactor Test (ART) and were indicated by approximate calculations. Operation of the ART over any extended period of time would have been accompanied by temperature cycling and, as a consequence, strain cycling. Data on the behavior of beryllium subjected to strain cycling at elevated temperatures are extremely limited, and therefore a reduced-scale experiment designed to test the ART reflector geometry under temperature conditions more extreme than those anticipated in the ART was conducted. The experiment verified the initial assessment of the situation; the test piece was extensively cracked and the direction and location of the cracks were as expected. A similar set of cracks in the ART reflector would probably not have caused serious trouble, but they might have permitted some of the sodium coolant stream to bypass the lower portion of the reflector and create an undesirable condition. (auth)

22420 PB-151306
Frankford Arsenal. Pitman-Dunn Lab., Philadelphia.
SURVEY OF LITERATURE ON THE EFFECT OF TESTING TEMPERATURE ON THE PROPERTIES OF

WROUGHT COPPER BASE ALLOYS. Report No. R-1435. H. R. Pritchard. Feb. 1958. 93p. DA Project No. 5B93-32-002. $2.25(OTS).

A literature survey on the effect of testing temperature in the range −300 to 1500°F on the properties of wrought copper-base alloys is presented. 36 references. (J.E.D.)

22421 SC-1814(TR)
Sandia Corp., Albuquerque, N. Mex.
THE REDUCTION OF GALVANIC CORROSION BY PROPER DESIGN OF EQUIPMENT. W. J. Cocke. May 18, 1951. Changed from OFFICIAL USE ONLY Apr. 12, 1956. 12p. $3.30(ph), $2.40(mf) OTS.

This report is intended to serve as a guide in the reduction of galvanic corrosion by the proper design of equipment. General principles are outlined, and special treatments are described for Al and Mg. (J.E.D.)

22422 SEP-254
Sylvania Electric Products Inc. Research Labs., Bayside, N. Y.
FUNDAMENTALS OF SINTERING—IV. Fourth Annual Progress Report [for] July 1, 1958 through June 30, 1959. J. Brett, L. S. Castleman, and L. Seigle. June 30, 1959. 33p. Contract AT(30-1)-2102. $1.00(OTS).

The disappearance of porosity during sintering in the absence of grain boundaries and free surfaces was studied in copper. Large-grained porous copper specimens were prepared by the dezincification of brass. After sintering, metallographic observations of the intragranular porosity at regions remote from grain boundaries and free surfaces reveal no significant densification, even though considerable decrease in the numbers and increase in the size of voids has occurred. It is concluded that intragranular sinks such as dislocations are not effective in eliminating vacancies during sintering. Also, evidence has been obtained that grain boundary activity and sintering atmosphere are interrelated. (auth)

22423 USNRDL-TR-348
Naval Radiological Defense Lab., San Francisco.
A METHOD OF DETERMINING THE THERMAL PROPERTIES OF METALS ABOVE 1000°K USING ELECTRICALLY HEATED WIRES. R. J. Jenkins, W. J. Parker, and C. P. Butler. July 16, 1959. 29p.

A procedure for determining the thermal properties of the refractory metals and alloys from 1000°K to within a few degrees of their melting points using electrically heated wires is described. Wire temperatures are measured optically using interference filters and photomultiplier tubes. Preliminary results on the total hemispherical emissivity, heat capacity, thermal conductivity, and electrical resistivity of tungsten between 1600 and 2900°K are compared with previously published values by earlier workers. (auth)

22424 WADC-TR-58-28
Babcock and Wilcox Co. Research Center, Alliance, Ohio.
THE STRENGTHENING OF AUSTENITIC SOLID SOLUTIONS. [Period covered]: June 15, 1956 to December 15, 1957. F. Eberle, J. H. Hoke, E. J. Rozic, and W. E. Leyda. Feb. 4, 1958. 69p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contracts AF33(616)-2413 and AF33(616)-5208. (AD-151161; PB-131992). $1.75 (OTS).

Among vacuum-melted wrought carbon-free alloys of Fe-Cr-Ni, Fe-Cr-Co, and Fe-Cr-Ni-Co, the compositions 10Fe-20Cr-70Ni and 20Cr-80Co have shown the highest 100-hour rupture strength at 1800°F. Strengthening susceptibility studies with these two base compositions by solid solution hardening, complex carbide hardening, and intermetallic compound hardening revealed that the nickel base responds most effectively to intermetallic compound hardening with Ti and Al, less so to complex carbide hardening, and not at all to solid solution hardening. The cobalt base responds to all three methods of strengthening; however, it does not attain as high a level of rupture strength at 1800°F as the nickel-base alloys. (auth)

22425 WADC-TR-59-258
Battelle Memorial Inst., Columbus, Ohio.
THE EFFECTS OF SOLUTE ELEMENTS ON THE STRENGTH PROPERTIES OF IRON- AND COBALT-BASE ALLOYS. Period covered: April 15, 1958 to April 14, 1959. Alan K. Wolff, Ervin E. Underwood, Robert E. Maringer, and George K. Manning. Apr. 1959. 68p. Project title: SOLID STATE RESEARCH AND PROPERTIES OF MATTER. Task title: INTERACTIONS, IMPERFECTIONS, AND ALLOY THEORY. Contract AF33(616)-5652. (AD-215432).

Factors important in high-temperature deformation were investigated in ternary iron-chromium-base alloys. These factors include various temperature, strength, and stability criteria, as well as lattice strain and valency changes. Relationships among these criteria are described. Periodicity of alloy strengthening in cobalt-base binary alloys reveals the most favorable solutes for strengthening, the influence of crystal structure, and the regularity of electronic effects. (auth)

22426 WADC-TR-59-389
Brown Univ., Providence. Metals Research Lab.
THE USE OF ULTRASONIC METHODS TO DETERMINE FATIGUE EFFECTS IN METALS. [Period covered]: June 16, 1958 to June 15, 1959. Rohn Truell, Bruce Chick, Amos Picker, and George Anderson. June 1959. 28p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: NON-DESTRUCTIVE METHODS. Contract AF33(616)-5884.

Changes in ultrasonic attenuation and velocity in commercially pure 1100 aluminum (Alcoa) when subjected to slow continued stress cycling (1 to 6000 cycles) and a delayed recovery phenomenon that appears when the cycling is interrupted were observed. An instrument to measure and record ultrasonic attenuation changes is described. (auth)

22427 WAL-TR-112/96
Watertown Arsenal Lab., Mass.
CORRELATION OF TOUGHNESS BETWEEN H-PLATE AND CHARPY IMPACT TESTS. W. P. Hatch, Jr. Sept. 1959. 32p. DA Project No. 5B93-32-002. (PB-151850). $1.00(OTS).

A post-ballistic metallurgical examination of a series of H-plates made from high and low hardness armor plate of different chemistries is reported. Examination included chemical analyses, macro- and microexamination, hardness surveys, and Charpy V notch transition tests of the armors both welded and unwelded. A correlation between transition data and ballistic performance of the H-plates is indicated. (auth)

22428 WAL-TR-310-1/1
Watertown Arsenal Lab., Mass.
MECHANICAL PROPERTIES OF AISI 4340 STEEL

IMPROVED BY CONSUMABLE-ELECTRODE VACUUM REMELTING. Serge Cvikevich. Sept. 1959. 55p. DA Project 5B93-32-003.

Based on beneficial effects on impact and fatigue properties observed on vacuum melting of steels, an investigation was conducted on the effects of remelting by the consumable-electrode process of aircraft quality AISI 4340 steel, which was originally melted by the basic electric furnace practice. Melting by the consumable-electrode process is normally done under vacuum and results in more efficient degassing than that obtainable with conventional crucible induction vacuum melting techniques. (auth)

22429 WAL-TR-320-1/1
Watertown Arsenal Lab., Mass.
HIGH STRENGTH STEEL: EFFECT OF VARYING COMPOSITION TO A TARGET HARDENABILITY, AND AN EXPERIMENTAL SILICON-RICH BORON-TREATED LOW ALLOY STEEL. S. V. Arnold. Oct. 1959. 37p. DA Project No. 5B93-32-003. (PB-161007). $1.00 (OTS).

The tensile, notched tensile, and impact properties of a number of experimental 0.30% carbon nickel–chromium–molybdenum steels, made to target composition of calculated 15" DI hardenability, were determined after quenching and tempering at 450°F. Tensile, notched tensile, and impact properties of an experimental 0.33% carbon silicon-rich boron-treated steel with moderate amounts of chromium and molybdenum, when quenched and tempered within the range 450 to 700°F, were exceptionally good. (auth)

22430 WAPD-218
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A THEORETICAL METHOD FOR DETERMINING THE WORTH OF CONTROL RODS. A. F. Henry. Aug. 1959. 56p. Contract AT-11-1-GEN-14. $1.50(OTS).

A method is described by which the worth of a control rod may be determined from a knowledge of the microscopic nuclear properties of the material from which the rod is constructed. It is assumed in the development that the medium external to the rod can be described adequately in terms of diffusion theory. Experimental tests of the theory for rods formed from slabs and inserted in light-water-moderated cores indicate that it is capable of predicting the k_{eff} of a core with control rods inserted to about the same degree of accuracy (±1%) as is possible with rods withdrawn. In addition to a detailed derivation of the theory and a description of various theoretical and experimental tests run to determine the limits of its validity, a section on approximation methods with numerical verifications for typical cases is given. (auth)

22431 WAPD-IPC-431
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].
INTERIM REPORT ON THE EVALUATION OF THE CR IV X-3-e LOOP TEST. T. V. Chleboski. [Feb. 1957]. Decl. June 16, 1958. 10p. $1.80(ph), $1.80(mf) OTS.

Information is given on post-irradiation evaluation of the CR IV X-3-e loop test in NRX reactor. The test consisted of irradiation of plates of Zircaloy-3 clad U–10 wt.% Nb (some defected) and a Zircaloy-2 clad U–12 wt.% Mo rod for 3 mo at 520 to 639°F surface temperature, 1686 psia, and 2 USgpm (4 ft/sec). Burnup was estimated to be 7200 Mwd/t or 0.65 at. %. The pre- and post-irradiation measurements are given and discussed. (T.R.H.)

22432 WAPD-PWR-PMM-2725
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh].
OUTLINE OF PWR ALTERNATE CONTROL MATERIAL INFORMATION OBTAINED AT BETTIS. [Report No. 17. Period Covered: April 15, 1958 to June 15, 1958]. 26p. $4.80(ph), $2.70(mf) OTS.

Corrosion, mechanical properties, welding, radiation effects, and creep properties of an Ag–15 In–5 Cd alloy were investigated. Results of the investigation indicated that the alloy was adequate as a control rod material for the PWR. (W.L.H.)

22433 WAPD-PWR-PMM-3807
[Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh].
PRE-IRRADIATION DATA SUMMARY OF THE WAPD 30-9 EXPERIMENT. J. D. Eichenberg, ed. [1959]. 32p. $6.30(ph), $3.00(mf) OTS.

Fabrication procedures and post-irradiation data from WAPD 30-9 experiment are presented. Description of the in-pile assembly is given and detailed post-irradiation data are tabulated. (J.R.D.)

22434 YAEC-148
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
FABRICATION OF WCAP-4 IN-PILE LOOP IRRADIATION TEST ASSEMBLIES. R. Schettig and R. King. Aug. 1959. 20p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph), $2.40(mf) OTS.

The fabrication procedures used in the manufacture of the test assemblies to be irradiated in WCAP-4 test loop in the MTR are presented. (auth)

22435 AEC-tr-3797
PREPARATION BY CALCINATION UNDER A CHARGE OF U–UC CERAMETS AND OF STOICHIOMETRIC MONOCARBIDE. (Preparation par Frittage Sous Charge de Cermets U–UC et de Monocarbure Stoechiometrique.) J. Dubuisson, A. Houyvet, E. Le Boulbin, R. Lucas, and C. Moranville. Translated by A. L. Monks (Oak Ridge National Lab.) from a French Report A/CONF.15/P/1162. $7.80(ph), $3.30(mf) JCL.

Preparation and properties of dense stoichiometric UC and U-ceramets at all C concentrations are described. Preparation was effected by calcination of metallic U powders and graphite. (J.R.D.)

22436 AEC-tr-3822
INFLUENCES ON THE SINTERING BEHAVIOR OF TUNGSTEN. J. Vacek. Translated for Los Alamos Scientific Lab. from Planseeber. Pulvermet. 1, 16-17 (1959). 12p. $3.30(ph), $2.40(mf) JCL.

Examinations of the influence of metal additions on the sintering behavior of tungsten powder have shown that nickel and cobalt–more than iron–do increase the reactivity during sintering. Other metals do not show any marked influence. The influence of nickel was rather closely studied, the amount of nickel added, the conditions for the reduction of the original tungsten powder, the pressure applied in compacting the powders, the sintering temperature and time being varied widely. The influence of nickel on the sintering of tungsten powder compacts was studied by measuring the density, hardness, specific electrical resistivity, and the transverse rupture strength of assintered specimens. Ni addition of as little as 0.25% (with sintering carried out for 1 hr at 1300°C) resulted in almost pore-free tungsten samples. Since this action can only be attributed to metals forming solid solutions with tungsten the

formation of vacancies during diffusion is considered the primary reason for it. In this connection, diffusion studies were staged on the metals of the iron group. Nickel was found to be the metal that diffuses most rapidly in tungsten. (auth)

22437 AEC-tr-3834
MICROHARDNESS OF BINARY HIGH-MELTING-POINT CARBIDES. A. E. Koval'skif (Kovalsky) and L. A. Petrova. Translated from Trudy Soveshchaniya Mikrotverdosti, 170-86(1950). 17p. $3.30(ph), $2.40(mf) JCL or LC.

The microhardness of binary carbides such as TiC–TaC, TiC–NbC, TiC–ZrC, TaC–VC, TaC–NbC, TaC–ZrC, NbC–ZrC, NbC–VC were examined. In addition the microhardness of limited solutions of Mo_2C and WC with the five listed carbides were measured. Data are included. (J.R.D.)

22438 AEC-tr-3836
DETERMINATION OF THE RATE OF DEFORMATION IN EXTRUSION AND DRAWING. J. Kocsis (Koosis) and L. Zachar. Translated for Savannah River Lab. from Kohászati Lapok 12, 71-5(1957). 10p. $3.30(ph), $2.40 (mf) JCL.

The velocity of deformation in various processes of plastic forming of metals at high temperatures is discussed. The increase of the rate of the deformation was found to change the physical properties of the material. Equations recommended for use in determination of the true and mean deformation velocity for the process of extrusion and drawing are given. (J.E.D.)

22439 AEC-tr-3845
DILATOMETRIC STUDY OF THE ZIRCONIUM/HYDROGEN SYSTEM BETWEEN AMBIENT TEMPERATURE AND 550°C. Lucien Espagno, Pierre Azou, and Paul Bastien. Translated for Los Alamos Scientific Lab. from Compt. rend. 247, 2003-5(1959). 4p. $1.80(ph), $1.80(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 11892.

22440 CEA-tr-R-337
DIFFUSION ET SOLUBILITÉ DU FER DANS LE GERMANIUM. (Diffusion and Solubility of Iron in Germanium.) A. A. Bugai (Bougai), V. E. Kosenko (Kossenko), and E. G. Miselyuk (Misseluk). Translated into French by B. de Trezvinsky from Zhur. Tekh. Fiz. 27, 210-11 (1957). 5p.

The coefficient of diffusion and the solubility of Fe in Ge were studied in the range 750 to 950°C using Fe^{59}. The solubility ranged from 0.5×10^{14} to 1.5×10^{15} atoms/cm^3 with a maximum at 850°C. The activation energy for diffusion E, and D_0 in the diffusion coefficient equation $D = D_0e^{-E/R+}$ was found to be E = 25,000 cal/mole (1.1 ev) and $D_0 = 0.13$. (T.R.H.)

22441 CEA-tr-R-516
ETUDE DE L'ADSORPTION INTERNE DU CARBONE DANS LE FER α PAR LA METHODE DU FROTTEMENT INTERNE. (Study of the Internal Adsorption of Carbon in α Iron by the Method of Internal Friction.) Pao-Tsui Yung and Ting-Sui Ke. Translated into French by I. Melnick from Fiz. Metal. i Metalloved. Akad. Nauk S.S.S.R., Ural'Filial 4, 407-16(1957). 23p.

The preliminary results obtained in the study of the internal adsorption of carbon in iron and steel by the internal friction method are reported. During a treatment causing a decarbonation of the sample, the carbon, which was in the adsorption zone, passes little by little into the lattice of the solid solution. The height of the internal friction peak, which is related to the carbon diffusion (the diffusion is initiated by stresses), is measured during each stage of the decarbonation. The behavior of the carbon adsorbed in the intercrystalline zone and at the grain interior is determined. The structure and properties of the adsorption zones are also determined. (tr-auth)

22442 CEA-tr-R-706
INFLUENCE DES MINÉRALISATEURS DANS L'AGGLUTINATION DES ZIRCONATES DES MÉTAUX ALCALINO-TERREUX. (Effect of Mineralizers in the Agglutination of the Zirconates of the Alkaline Earth Metals.) E. K. Keller, N. A. Godina, A. B. Kuznetsov (Kouznetsov), and A. B. Andrieva. Translated into French from Zhur. Priklad. Khim. 30, 682-9(1957). 16p.

In the preparation of ceramics of alkaline earth zirconates, mineralizers are used to assure a hard, well-agglomerated specimen at 1400°C. For mixtures containing (in mole %): 50 ZrO_2 + 50 $CaCO_3$, and 50 $CaCO_3$ + 48 ZrO_2 + 2 TiO_2, 1 wt. % B_2O_3 is the best mineralizer. For 50 ZrO_2 + 50 $BaCO_3$, and 50 ZrO_2 + 50 $SrCO_3$, 2 wt. % Fe_2O_3 as mineralizer is best. Mineralizers lower the agglomeration temperature significantly but affect the temperature of zirconate formation only slightly. Thermal analysis techniques revealed information about the reactions involved. (T.R.H.)

22443 CEA-tr-R-710
DOSAGE DE LA PHASE-α DANS LE MÉTAL AUSTÉNITIQUE D'UN CORDON DE SOUDURE PAR LA MÉTHODE MÉTALLOGRAPHIQUE. (Determination of the α Phase in the Austenite Metal of Welding Ring by the Metallographic Method.) A. D. Kuznetsova-Sadovnikova. Translated into French by B. Vinogradoff from Svarochnoe Proizvodstvo, No. 1, 34-6 (1958). 6p.

A metallographic technique for determining the α-phase present in austenitic weldments is given. A reagent mixture containing 10 g $K_4Fe(CN)_6$, log NaOH, and 100 g H_2O is prepared and the specimen put in cold. Then it is brought to a boil. After boiling the specimen is washed with cold water, dried in still air, and examined at 1000X. (T.R.H.)

22444 CEA-tr-X-147
CONSIDÉRATIONS SUR LE RÉTRÉCISSEMENT AU FRITTAGE. (Considerations on Contraction in Fritting.) K. Kubo, K. Kanriki, and K. Hisataka. Translated into French by S. S. Minn from Kôgyô Kagaku Zasshi 61, 918-22(1958). 23p.

An equation was deduced relating the speed of fritting and shrinkage as fritting progresses. Consider two particles in contact. The heating causes a bonding and the centers of the particles move closer together. This decrease in distance corresponds to the shrinkage, and if one assumes that the displacement is fluid movement of a viscous or plastic nature one obtains the following equations: $d(\Delta L/L)/dt = k\,(L/\Delta L)^{1/3}$ for viscous movement and $d(\Delta L/L)/dt = k\,[(L/\Delta L)^{1/3} + x\,(L/\Delta L)^{1/4}]$ for plastic, where $\Delta L/L$ is the coefficient of linear shrinkage, L is the initial length, ΔL is the linear shrinkage, t is time, and k and x are constants defined by the grain diameter, viscosity, and the surface tension of the material. This equation agreed with experimental results obtained on glass powder, TiO_2, NiO, and $BaTiO_3$. (T.R.H.)

22445 NP-tr-298
EFFECT OF VARIOUS ADMIXTURES ON PROTEC-

TION OF COPPER AGAINST OXIDIZATION AT HIGH TEMPERATURES. (Vliyaniye Razlichnykh Dobavok Na Zashchitu Medi Ot Okisleniya Pri Vysokikh Temperaturakh.) M. V. Zakharov and T. V. Kalinina. Translated for Wright-Patterson AFB from Issledovanie Splavov Tsvetnykh Metal. Akad. Nauk S.S.S.R., Inst. Met. im. A. A. Baĭkova, No. 1, 111-16(1955). 11p.

Oxidation of cupric alloys possessing relatively high electric and thermal conductivities at elevated temperatures (500 to 800°C) were investigated. The addition of Al, Be, and Mg even in small quantities produces alloys which have the highest oxidation resistance. The copper alloys designated Mu2 and Mu4 intended for use in electric-arc welding electrodes were found to have high oxidation resistance. (J.R.D.)

22446

THE DIFFUSION OF SOME ELEMENTS IN ZnSb AND CdSb. A. A. Kuliev and G. B. Abdullaev (Inst. of Physics, [SSR]). Akad. Nauk Azerbaidzhanskoi S.S.R., Doklady 15, No. 1, 9-11(1959). (In Russian)

Labeled atoms (Zn^{65}, Fe^{59}, and Cd^{114}) were used for determining Zn diffusion coefficients in ZnSb and Cd and Fe in CdSb. The fusion of layers and radioactivity of certain layers were examined. Effects of thermodynamic factors on diffusion coefficients were determined. In most cases the activation rises with the increase of atomic radius. (R.V.J.)

22447

CRYSTALLINE STRUCTURE OF LEAD, STRONTIUM AND BARIUM METATANTALATES. I. G. Ismailzade (Inst. of Petroleum, [SSR]). Akad. Nauk Azerbaidzhanskoi S.S.R., Doklady 15, No. 1, 13-16(1959). (In Russian)

X-ray studies were made of the polycrystalline structure of lead, barium, and strontium metatantalates. The correlation of powder diagrams of $PbTa_2O_6$, $BaTa_2O_6$, and $SrTa_2O_6$ with $PbNb_2O_6$ indicate an isostructure. The enlargement of $PbTa_2O_6$ and $BaTa_2O_6$ elementary cells is caused by the Pb^{2+}(1.26A) and Ba^{2+}(1.38A) ion radii. The absence of spontaneous $SrTa_2O_6$ and $BaTa_2O_6$ polarization can be explained by the low polarizability of Sr^{2+}(α = 1.42) and Ba^{2+}(α = 1.69) with respect to Pb^{2+} (α = 4.32). (R.V.J.)

22448

A MOLTEN METALS HEAT CONDUCTIVITY CALCULATION. G. F. Butenko and M. I. Radchenko. Atomnaya Energ. 6, 205-7(1959) Feb. (In Russian)

Data on heat transfer of molten metals were extrapolated to elevated temperatures. The dependence of the Lorentz function in Al, Pb, Sb, Sn, and Zn on temperature and the universal dependence of the dimensionless Lorentz function on temperature are plotted. An equation is derived for determining the heat transfer of liquid metals at various temperatures when the data on heat conductivity, electric conductivity, and melting point temperature, and the electric conductivity at fixed temperatures are available. (R.V.J.)

22449

TESTS SPEED EVALUATING MATERIAL'S RESISTANCE TO RADIOLOGICAL CORROSION. A. E. Salo and N. B. Garden (Univ. of California, Berkeley). Chem. Processing 22, No. 7, 67-8(1959) July.

A spot-test method was developed for rapidly checking radiological corrosion resistance. The test actually consists of a series of tests: chemical corrosion, radiological contamination and decontamination, and irradiation. (W.L.H.)

22450

POTENTIALITIES AND APPLICATIONS OF SPECIAL CORROSION RESISTANT REFRACTORIES. Roy W. Brown and H. G. Noble (Carborundum Co., Perth Amboy, N. J.). Corrosion 15, No. 10, 92, 94, 96, 98(1959) Oct.

Severe corrosion conditions coupled with abrasion, erosion, and moderate to high temperatures create demands for special refractories having properties that make them suitable substitutes for metals in selected applications. Characteristics of special refractories and current applications are discussed with emphasis on their metal-like properties of thermal conductivity, hot compressive strength, and abrasion resistance. An explanation of how products can resist extreme conditions of tension, thermal shock, and impact by redesign is given. (auth)

22451

DECOMPOSITION OF THE CARBIDE PHASE OF WHITE CAST IRON-CEMENTITE UNDER THE ACTION OF NEUTRON RAYS. I. M. Pronman, V. A. Shalashov, A. Kh. Breger, and Yu. A. Zubov (Karpov Research Inst. of Physics and Chemistry). Doklady Akad. Nauk S.S.S.R. 127, 1259-62(1959) Aug. (In Russian)

Alterations in the Fe_3C and Fe ratio in irradiated and non-irradiated cementite specimens were analyzed after annealing at various temperatures from 650 to 1100°C in a vacuum. It was found that neutron bombardment initiated the formation of crystal nuclei which at temperatures below austenite crystallized into α Fe and at austenite temperature into γ Fe. Data on the phase composition of irradiated and non-irradiated cementite specimens, tabulated according to annealing conditions, show that carbon crystallizes only at temperatures >1000°C and independently of the amount of separated iron. The tests indicate that even negligible doses of neutron irradiation initiate nuclei of iron and graphite which with large doses of irradiation could crystallize into new phases. (R.V.J.)

22452

THE SUPERPOSITION OF AUTORADIOGRAPHS AND MICROGRAPHS USING THE KODAK DYE TRANSFER PROCESS. S. M. Makin and G. T. Rogers (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Intern. J. Appl. Radiation and Isotopes 5, 302(1959) July.

A kodak dye transfer process is described for making a composite print showing the autoradiograph and micrograph of metallic specimens in appropriate colors. The autoradiograph and micrograph are used in place of separation negatives to make composite prints which are more easily interpreted than separate or superposed black and white prints. Examples shown include an autoradiograph obtained using copper-64 as a tracer to show the distribution of copper in an aluminum–copper alloy, and the distribution of chromium in an aluminum–zinc–magnesium–chromium alloy. The matrices were dyed to give a suitable contrast in colors. (C.H.)

22453

SMELTING HIGH-MELTING POINT ALLOYS IN VACUUM INDUCTION FURNACES. V. I. Kashin and A. M. Samarin. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 3, 29-33(1959) May-June. (In Russian)

Data are presented on the effects of vacuum furnace smelting on the deformation of high melting point, nicke base alloys. (R.V.J.)

22454

NIOBIUM DISTRIBUTION BETWEEN IRON AND IRON SLAG. M. L. Sasonov and L. A. Shvartsman. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 3, 34-6(1959) May-June. (In Russian)

Thermodynamic functions of niobium oxidation in liquid iron are analyzed. The transition heat of 1 g at. of Nb is 70,500 cal. Correlations of the data show that niobium is present in the slag as pentavalent oxide. (R.V.J.)

22455

EFFECTS OF ORIGINAL STEEL STRUCTURE ON TENDENCIES TO HOT-CRACKING. O. D. Moldavskii and A. P. Pronov. Izvest. Akad. Nauk S.S.S.R., Otdel Tekh. Nauk Met. i Toplivo, No. 3, 47-51(1959) May-June. (In Russian)

The effects of Al, Cr, and Si content on the tendencies of low-carbon steel to hot-cracking are studied. The strength of the hardened steel is 0.4 to 0.8 kg/mm^2 and is strongly related to its original structure. The plasticity of steel at hardening temperature also affects its tendencies to hot-cracking. (R.V.J.)

22456

TEMPERATURE DEPENDENCE OF HARDNESS OF NICKEL ALLOYS. M. E. Blanter and L. I. Kuznetsov. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 3, 75-82(1959) May-June. (In Russian)

The hardness of cold deformed (5, 10, 25, and 38%) specimens heated to 1000 to 1100° at 50 to 100° intervals was measured at room temperature. The effects of Cr, Co, and Ti alloying on the temperature dependence of alloyed nickel hardness were studied. (R.V.J.)

22457

ON THE MECHANISM OF OXIDATION OF NICKEL AND CHROMIUM BASE ALLOYS. D. V. Ignatov and R. D. Shamgunova. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 3, 83-7(1959) May-June. (In Russian)

The effects of alloying elements (Al and Ti) concentration, temperature, and oxidation time on oxidation kinetics, structure, composition, and rate of oxide film deposition were investigated. Specimens with 80% Ni and 20% Cr; Ni with 20% Cr and 1, 4.18, 7.22, and 10% Al; and, Cr–Ni–Ti with 20% Cr and 0.68, 3.44, 5.88, and 9.76% Ti were tested at 600 to 1000°C. (R.V.J.)

22458

STRUCTURE AND PROPERTY CHANGES IN ALUMINUM AND Al ALLOYS TREATED WITH ULTRASONIC WAVES. M. B. Al'tman, V. I. Slotin, N. P. Stromskaya, and G. I. Eskin. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 3, 88-91(1959) May-June. (In Russian)

Changes in the structure and properties of pure Al, Al–Mg–Si, and Al–Cu–Mg–Si affected by treatment with ultrasonic waves from titanium wave guides were studied. (R.V.J.)

22459

DETERMINATION OF TITANIUM OXIDE INCLUSIONS IN STEEL. Yu. T. Lukashevich-Duvanova and V. A. Urazova. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 3, 108-12(1959) May-June. (In Russian)

A method is offered for determining oxide inclusions in low-carbon iron alloyed with titanium. It was found that the amounts of titanium residue in low-carbon steel without silicon affect the composition and character of oxide inclusions. Inclusions of ilmenite are formed with 0.05 to 0.2% Ti; with 0.1 to 0.85% Ti, the inclusions appear as Ti_2O_3. Preliminary oxidation with silicon followed by the addition of 1% Ti forms silicates containing titanium oxides. An increase of Ti increases the amount of Ti_2O_3 in the silicate phase. (R.V.J.)

22460

ACTIVATION ENERGY IN CREEP AND STRESS RUPTURE OF ALUMINUM. K. A. Osipov and A. L. Sotnichenko (Inst. of Metallurgy, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 3, 139-141(1959) May-June. (In Russian)

Activation energy for creep and stress rupture was determined for 99.9% pure Al, annealed for 14 hours at 550°C under stresses of 1 to 6 kg/mm^2. (R.V.J.)

22461

HARDNESS OF Ti ALLOYS AT ELEVATED TEMPERATURES. V. S. Mikheev and S. G. Fedotov (Inst. of Metallurgy, Academy of Sciences, USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 3, 144-5(1959) May-June. (In Russian)

Hardness of hexacomponent titanium alloys (α titanium with B, Cr, Fe, and Si) with various contents of Al (0.5, 1.0, 3.0, 4.5, 6.0, 7.5, 10, and 12 wt. %) was tested after forging and annealing. An increase in Al content improved the hardness of all alloys at all temperatures. (R.V.J.)

22462

URANIUM SURFACE LAYER STRUCTURE AFTER ELECTRICAL SPARK TREATMENT. B. V. Sharov. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk Met. i Toplivo, No. 3, 148-50(1959) May-June. (In Russian)

X-ray-diffraction studies of technically pure uranium rods 4-mm in diameter and 20 mm long showed a specific textured structure in the spark layer caused by melting, crystallization, and phase transformation. The shock of the spark discharge is also considered. (R.V.J.)

22463

PROPERTIES OF IRON–NICKEL ALLOY COATINGS. N. V. Korovin and P. S. Titov. Izvest. Vysshikh Ucheb. Zavedenii, Tsvetnaya Met., No. 1, 164-70(1958). (Translated from Referat. Zhur. Met. No. 10, 1958, p.131).

The results of a study of the structure and properties (microhardness, internal stresses, and magnetic characteristics) of electrolytic Fe-Ni coatings deposited from sulfate and chloride electrolytes of various compositions onto polished Cu sections are presented. The phase composition was determined by x-ray diffraction. The hardness of the Fe-Ni coatings proved to be greater than the hardness of Fe and Ni deposits (especially from sulfate solutions) and approaches the hardness of electrolytically deposited Cr. Electrolytically deposited Fe-Ni alloy exhibits high internal stresses owing to the distortion of the lattice parameters, possesses a very fine crystalline structure and luster, and constitutes a solid Fe-Ni solution. Electrolytically deposited alloys exhibit a higher coercive force and a lower residual induction than rolled and heat-treated alloys. The great hardness, the beautiful appearance, and a sufficiently high corrosion resistance of coatings containing up to 30% Fe provide a basis for the assumption that they might replace nickel and sometimes even chromium coatings.

22464

FORMATION OF GRAPHITE EUTECTOID IN IRON. V. F. Senkevich and M. Kh. Fakhrutdinova. Izvest. Vysshikh Ucheb. Zavedenii, Chernaya Met., No. 4,

143-6(1958). (Translated from Referat. Zhur. Met., No. 12, 1958, p.165).

Breakdown of austenite (A) with formation of a graphite eutectoid was observed in the investigation of hypereutectic gray iron (I). The metal base of the I in the initial state had a pearlite structure with a graphitic structure of homogeneous size. The kinetics of the breakdown of the I were investigated at 850 and 1000°C at which temperatures the C content in A is 0.5 and 0.9%, respectively. The feasibility of formation of a graphite eutectoid upon the breakdown of super-cooled A in I was experimentally verified, and the diagram of the isothermal breakdown of A in I in the low supercooling range was rendered more precise by plotting the curve of the beginning of the formation of the graphite eutectoid.

22465

ABRASIVE WEAR OF ALUMINIUM–MAGNESIUM ALLOYS AT VARIOUS TEMPERATURES. V. N. Kashcheyev and L. N. Voytsekhovksaya. Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz., No. 1, 57-62 (1959).

The abrasive wear and "hot" hardness of alloys of aluminium and magnesium of various concentrations was investigated at various temperatures. Specimens, cast into a chill mold and subsequently annealed, were studied. They had the following concentrations: 0, 1, 4, 8, 16, and 20% by weight of technically pure magnesium, the remainder being technically pure aluminum. The following temperatures were selected for testing: 20, 100, 200, 300, and 400°C. The face of a cylindrical specimen of 5 mm diameter, gripped in tongs, was rubbed against the flat surface of a slowly revolving electro-corundum disk of medium hardness and grain size, bonded with a ceramic material. The wearing specimen and the abrasive disk were situated inside an electric furnace. The normal load on the specimen was constant (3 kg). The amount of wear was estimated by weighing the specimens before and after the experiment with an accuracy of up to 0.1 mg. The dependence of the total wear of alloys on their concentration at various temperatures is shown. Also, the dependence of total wear on temperature is shown. An aluminium-magnesium equilibrium diagram is included together with wear resistance curves. The reciprocal of the total wear is taken as wear resistance. The relationship between rubbing force and temperature for alloys of the concentrations investigated is given. The hot hardness, tested by the same equipment at the same temperatures, was taken as a characteristic of mechanical properties. The hardness was calculated. The relationships between hot hardness and alloy concentration at various temperatures, and hot hardness and testing temperature for various concentrations, are shown. The wear by firmly gripped abrasive grains leads to local destruction of the metal by scratching. An effort was made to find a relationship between the volume of metal removed from the surface and the extent of plastic deformation brought about by scratching, which is expressed by the so-called "piling-up" of metal. Specimens containing 0.8 and 16% Mg, were scratched at a load of 0.750 kg. Scratching was carried out at 20, 200, and 400°C at very low speed. A typical cross-section of the metal surface, perpendicular to the scratch, is included. The results indicate that the abrasive wear of alloys at low temperatures is the lower, the greater the magnesium content and the greater the static distortions at a constant bond force. This does not apply for high temperatures, as the melting point of the alloy and the degree to which it softens begin to exert a decisive influence. Between the wear resistance and hot hardness there is only a qualitative relationship, and that only at low temperatures. The concentration of saturation of the solid solution by magnesium at various temperatures does not exert any influence on the wear resistance curves. The friction force does not to any extent characterize the resistance to abrasive wear. (TCO)

22466

PHOTOPRODUCTION OF π-MESON PAIRS IN HYDROGEN AND DEUTERIUM. N. V. Dushin. Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz. No. 4, 114-19(1958).

The ratio of the two differential cross-sections $d\sigma(\gamma + d \rightarrow p + n + \pi^+ \pi^-)/d\sigma(\gamma + p \rightarrow p + \pi^+ + \pi^-)$ are calculated. The method is first applied by way of illustration to the reaction $\gamma + p \rightarrow n + \pi^+ + \pi^0$. The effective potential V assumes the form, $V = [\underline{B}, \underline{\epsilon}]\ \underline{\sigma}\ \delta(r_n - r)\tau_n$. Here $\underline{B}$ is the vector $a_{12}\ \underline{k}_1 + a_{21}\ \underline{k}_2$ associated with the incident γ-quantum having propagation and polarization vectors $\underline{k}_\gamma$, and $\underline{\epsilon}$ respectively; $\underline{\sigma}$ is the standard spin operator for the system, $\sigma(r_n - r)$ the Dirac delta function referred to the nuclear co-ordinate, and r_n, and τ_n an operator referring to the creation of the meson pair, in this case $\pi^+ + \pi^0$. For $\pi^+ + \pi^-$ pair production τ_n breaks down into positive and negative parts, and for the deuteron reaction V breaks down into neutron and proton parts. The basic equation for $d\sigma$ is

$$d\sigma = \frac{2\pi}{c}|[\underline{B}_p, \underline{\epsilon}]|^2\ \delta(E_0 - E_f)\frac{d\underline{k}_1}{(2\pi)^3}\cdot\frac{d\underline{k}_2}{(2\pi)^3}.$$ Here E_0 and E_f are the initial and final nuclear energies and the other symbols are as defined above. The interaction Hamiltonian for the complete system in general includes a tensor term S as well as the central potential V. This Hamiltonian evaluated between the initial and final states leads to the $|[B, \epsilon]|^2$ term. E_0 and E_f then follow from the usual kinetics. Because of indeterminate normalization factors the absolute evaluation of $d\sigma$ is not attempted. (TCO)

22467

OSCILLOGRAPHIC STUDY OF STRESS RELAXATION IN ALUMINIUM AFTER PLASTIC EXTENSION WITH DIFFERENT VELOCITIES. L. M. Butkevich. Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz., No. 6, 3-8(1958).

The test material was polycrystalline aluminum (Al 99.81%, Si 0.17%, Fe 0.02%). A relaxation coefficient α and a velocity coefficient ζ are defined by the relations $\alpha = \frac{\Delta\sigma}{\sigma\Delta t}\cdot 100$ and $\zeta = \frac{\sigma(v) - \sigma(v_0)}{\sigma(v_0)}\cdot 100$, where σ is the stress at the instant of attaining a prescribed degree of deformation, $\Delta\sigma$ is the fall in stress during the time interval following the start of relaxation, $\sigma(v_0)$ is the stress at a prescribed degree of deformation following extension with velocity v_0 and $\sigma(v)$ is the stress at the same degree of deformation following extension with velocity $v > v_0$. Curves are given showing the variation of α with Δt, with log v and with degree of deformation ε and of ζ with log v. It was concluded that α falls with increasing Δt, and for small Δt, α increases markedly with log v. Also for small Δt, the $\alpha - \epsilon$ curves have a maximum at intermediate deformation (approximately 12%). (TCO)

22468

DEPENDENCE OF FLOW STRESS IN NICKEL ON DEFORMATION VELOCITY AND TEMPERATURE.

L. Ye. Popov and N. A. Alexsandrov. Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz., No. 6, 66-72(1958).

Two series of experiments were carried out on nickel. One series at deformation velocities of 1440, 350, 70, 38, 26, 8.2, and 4.8% per hour, all at 414°C, the other series at a constant deformation velocity of 51% per hour and at 350 to 473°C. Stress-deformation curves of both sets are presented. Curves of flow stress against log velocity and against T_1 (T = temperature) indicate that the activation energy is about 66,000 cal/mole. (TCO)

22469

INFLUENCE OF VELOCITY VARIATION ON EXTENSION CURVES OF ALUMINIUM SINGLE CRYSTALS. L. I. Vasil'yev, Ch'iu-san Ch'ing, Ts'e-ting Wu, Ch'i-t'ung Li, and Hung-tu Chang. Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz., No. 6, 99-105(1958).

Experiments were carried out on high-purity aluminum (Al ≥ 99.99%, Fe ≤ 0.0035%, Si ≤ 0.0025%, and Cu ≤ 0.005%). The single crystals were produced by recrystallization and their orientation was determined from Lane diagrams. The experiments consisted of extending the specimens at a velocity v until the relative extension reached 19%, and changing the velocity suddenly from v_1 to v_2. In some of the experiments, v_1 was 0.04% per minute and v_2 40% per minute; in others v_1 was 40% per minute and v_2 0.04% per minute. The stress-strain curves with relative extensions up to 70% are plotted, together with the derived shear curves. It is found that the stress-strain curve is discontinuous at the point of velocity change and differs for different velocities. (TCO)

22470

DIFFUSION OF ALUMINUM, MAGNESIUM, SILICON, AND ZIRCONIUM IN NICKEL. Herbert W. Allison and Harold Samelson (Bell Telephone Labs., Murray Hill, N. J.). J. Appl. Phys. 30, 1419-24(1959) Sept.

The diffusion rates of aluminum, magnesium, silicon, and zirconium, alloyed as single additives in nickel, were measured at temperatures between 800 and 970°C. The method consisted of measuring the weight gain caused by surface oxidation of the additive in a wet hydrogen ambient. The surface oxides were identified by electron diffraction. Grain size was about 0.05 mm in Al-Ni, Si-Ni, and Mg-Ni but less than 10^{-3} mm in Zr-Ni. The composite volume and grain boundary diffusion coefficients are given by $D_{Al\rightarrow Ni} = 1.1 \exp(-59{,}500/RT)$; $D_{Mg\rightarrow Ni} = 2.3 \times 10^{-5} \exp(-31{,}300/RT)$; $D_{Zi\rightarrow Ni} = 10.6 \exp(-64{,}800/RT)$; $D_{Zr\rightarrow Ni} = 1 \times 10^{-5} \exp(-26{,}700/RT)$. Stereo and photomicrographs indicate considerable grain boundary diffusion, particularly in Mg-Ni and Zr-Ni. (auth)

22471

METALLURGICAL DEVELOPMENTS OUTLINED AT THE 1958 GENEVA CONFERENCE ON PEACEFUL USES OF ATOMIC ENERGY. H. M. Finniston (C. A. Parsons, Ltd., Nuclear Research Centre, Newcastle-upon-Tyne, Eng.). J. Inst. Metals 87, 360-75(1959) July.

A summary is given of the metallurgical papers presented at the 1958 Geneva Conference. The papers come under four headings: materials, including fabrication and effects of heat and radiation on physical and mechanical properties; radiation effects on non-fissionable materials; fuel elements; and liquid-metal fuels. (C.J.G.)

22472

INVESTIGATION OF CORROSION ALUMINUM UNDER CONDITIONS OF AN OPERATING ATOMIC REACTOR. András Domony. Kohászati Lapok 90, 542-50(1957). (Translated from Referat. Zhur. Khim. No. 1, 1959, Abstract No. 1631.)

Corrosion by water of aluminum with additions of Fe, Ti, Si, and B was investigated at a high pressure and temperature. It was established that the alloys of Al, containing intermetal compounds have the best corrosion resistance.

22473

PROBLEMS OF CRYSTALLIZATION OF GRAPHITE IN ALLOYS OF IRON AND CARBON. D. P. Ivanov. Kovkiĭ Chugun (Moscow: Gosudarat. Nauch.-Tekh. Izdatel. Mashinostroitel. Lit.) Sbornik, 78-126(1954). (Translated from Referat. Zhur. Met. No. 6, 1957, p.214).

A presentation is made of the results of studies of various types of native graphite (G). An investigation is made of the structure of G in various alloys of iron and carbon (IC) in which the initial G structure is compact spheroidal with signs of hexagonal structure. All the other structural forms of G must be regarded as derivative and determined by the conditions of alloy crystallization. In molten iron G appears as more or less hexagonal inclusions, and the crystallization thereof in the form of blocks that are close to hexagonal in shape is entirely in order and appropriate to its crystal lattice. There is no evidence for considering the structure of flake G as the initial or natural form. The form of precipitated G (flake, rosette, or eutectic) depends upon the rate of cooling of the metallic phase. The properties of G manifest themselves most fully in Mg iron. The concept that the G grain grows in the form of successive increments of concentric layers of C atoms occuring as even precipitation from the liquid solution is wrong. Graphite inclusions are conglomerates of sandwiches of flat layers of G retaining the configuration characteristic of the crystal lattice of G as they grow larger. Other factors in crystallization (diffusion through a solid solution from the onset of crystallization, uniform accretion of C atoms by the growing crystal, influence of surface films, etc.) are not decisive. (TCO)

22474

INVESTIGATION OF THE DEFECT STRUCTURE OF METALLIC MONOCRYSTALS BY A NEUTRON DIFFRACTION METHOD. B. G. Lyashchenko, D. F. Litvin, I. M. Puzey, Yu. G. Abov, and V. S. Golovkin. Kristallografiya 3, 148-54(1958).

A neutronographic investigation of the structure of nickel alloy single crystals was made and the effect of this structure on the character and intensity of the scattered neutron beams is demonstrated. A short review of work on the neutronographic investigation of the structures of synthetic single crystals is included. One of the consequences of the low absorption of neutrons in most materials is the importance of secondary extinction. The effect of volume defects of dimensions greater than those of the mosaic blocks is of interest and leads to the break-up of diffraction spots into small patches. 14 specimens of monocrystals were examined. They were alloys of Ni and Fe with different quantities of Mo, Cr, and Cu. Most specimens showed anomalous reflection curves. Contour plots were made of various reflections. Diagrams for the 020 reflection of two

Ni–Fe alloys are reproduced. X-ray investigation of the specimen disclosed appreciable boundary regions separating fragments disoriented by up to 20′. This caused the reflections 222, $2\bar{2}2$, $\bar{2}22$, and $\bar{2}\bar{2}2$ to come only from one fragment and $\bar{2}\bar{2}2$, $\bar{2}2\bar{2}$, $2\bar{2}2$, and $22\bar{2}$ to come from the other. (TCO)

22475

A NEW CRYSTAL PHASE IN THIN FILMS OF Fe–Ni ALLOYS. B. Ya. Pines and I. P. Grebennik. Kristallografiya 3, 461-6(1958).

In an electron diffraction examination, a new phase was discovered in thin Fe–Ni films at 650°C. Electronograms obtained at −40° to 650°C showed lines which could be indexed on an orthorhombic cell with a = 3.42, b = 5.9, and c = 5.06 KX. The structure appears pseudohexagonal and it is suggested that it has a NiAs cell containing 9 Ni and Fe atoms. Rough intensity measurements give some support for this hypothesis. The observed lines occur with d values (in KX) of 2.96, 2.54, 2.52, 1.92, 1.613, 1.48, 1.47, 1.269, 1.019, and 0.916. Their intensities are w, m, vw, vvs, w, m, m, m, w, w, respectively. (TCO)

22476

RADIO-ISOTOPES AND SOVIET STEEL. Arthur B. Tesmen (Baldwin-Lima-Hamilton Corp., New York). Metal Progr. 76, No. 3, 115-20(1959) Sept.

The uses of radioisotopes for quality control in ferrous and nonferrous production, melting, casting, and fabrication are discussed. Blast furnace techniques have been devised to measure stock feeds, wear on furnace bottoms and charge levels. In the refining process, work is reported on dephosphorization, desulfurization, scrap melting, and slag formation. (C.J.G.)

22477

REGULARITIES IN MECHANICAL AND TECHNOLOGICAL PROPERTIES OF TITANIUM BASE TERNARY ALLOYS. L. P. Luzhnikov and V. M. Novikova. Metalloved. i Termichesk. Obrabotka Metal. No. 3, 6-13 (1959) Mar. (In Russian)

Systematic studies were carried out on the mechanical and technological properties of ternary titanium alloys of Al–Mo–Ti, Al–Cr–Ti, Al–Mn–Ti, Al–Fe–Ti, and Fe–Mn–Ti with 94% Ti. Alloying Al–Ti with β stabilizers close to their maximum solubility in α-titanium, results in high stability alloys with satisfactory plasticity and welding properties. (R.V.J.)

22478

EFFECTS OF RARE METALS ON MECHANICAL PROPERTIES OF IRON–ALUMINUM ALLOYS. E. M. Savetskii, V. F. Terekhova, and I. V. Burov (Metallurgical Inst., Academy of Sciences, U.S.S.R.). Metalloved. i Termichesk. Obrabotka Metal. No. 3, 38-43(1959) Mar. (In Russian)

Studies were made of the effects of small admixtures of Ce, B, Mo, Nb, Ta, Ti, V, and Zr on the mechanical properties of Fe–Al alloys (16 wt. % Al). The presence of oxygen was the most harmful, causing fragility. Induction melting in crucibles in a helium atmosphere considerably improves mechanical properties. The investigated alloys have high corrosion resistance at 1200° in atmosphere. (R.V.J.)

22479

BETA-POLYMORPHS OF URANIUM AND THORIUM DISILICIDES. A. Brown and J. J. Norreys (General Electric Co., Ltd., Wembley, Eng.). Nature 183, 673 (1959) Mar. 7.

The "β-USi_2" and "β-$ThSi_2$" phases were prepared from mixtures containing 62 to 63 at. % Si as compared with 66.7% Si required for formation of the α-disilicides. X-ray-diffraction and metallographic studies indicate that the compositions are U_3Si_5 and Th_3Si_5, and the cell dimensions are: $U_3Si_5 - a_0 = 3.843 \pm 0.001$ A, $c_0 = 4.069 \pm 0.001$ A, and $Th_3Si_5 - a_0 = 3.985 \pm 0.001$ A, $c_0 = 4.228 \pm 0.001$ A. In a study of reactions in the U–Th–Bi–Si systems, hexagonal phases with space group C6/mmm were found. These phases, like the M_3Si_5 compounds, have the AlB_2 structure but the cell dimensions are different. Heat treatment of the Th–Si compound at 1200 to 1300°C produced α–$ThSi_2$ which, when heated at 850°C, yields the new Th–Si phase, the true β-$ThSi_2$. The cell dimensions are: β-$USi_2 - a_0 = 4.028 \pm 0.001$ A, $c_0 = 3.852 \pm 0.001$ A, and β-$ThSi_2 - a_0 = 4.136 \pm 0.001$ A, $c_0 = 4.126 \pm 0.001$ A. (T.R.H.)

22480

ELECTRON MICROSCOPY OF THIN SECTIONS OF AN Al–Ag ALLOY. L. Reimer (Universität, Münster, Ger.). Naturwissenschaften 46, 443(1959). (In German)

An investigation was made to determine whether strong compression occurred in the cutting direction of Al–Ag alloys in the preparation of transparent sections for electron microscopic study. Therefore, measurements were made to determine the length of the separation which forms an angle with the cutting direction and the length of the separation perpendicular to the cutting direction. The alloy was submitted to various heat treatments. The results are tabulated. (J.S.R.)

22481

LIGHT ALUMINUM OXIDE REFRACTORIES. I. Ya. Guzman and D. N. Poluboyarinov. Ogneupory 24, No. 2, 71-9(1959).

The production possibilities of pure light corundum products of high porosity, sufficient strength, and volumetric stability at high temperatures were examined. For this purpose technical alumina which had been burned at temperatures of 1450 and 1600°C was used. In order to increase the crystal growth, 1 to 2% TiO_2 was added to the alumina. It was concluded that pure light corundum materials with a wide range of specific weights can be produced from alumina by the foam method. Products of pre-burned alumina show the best qualities. The light corundum blank shows little strength as well as a high shrinkage in drying and burning, and should be burned at 1700 to 1750°C. By adding 1 to 2% of TiO_2 the burning temperature can be reduced to 1550°C. The light corundum-foam product may serve as heat-insulating material up to 1750°C. (TCO)

22482

ANTIFERROMAGNETIC STRUCTURES OF MnS_2, $MnSe_2$, AND $MnTe_2$. J. M. Hastings, N. Elliott, and L. M. Corliss (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 115, 13-17(1959) July 1.

The antiferromagnetic structures of MnS_2, $MnSe_2$, and $MnTe_2$ were obtained by neutron diffraction. The disulfide exhibits ordering of the "third" kind, the ditelluride, ordering of the "first" kind, and the diselenide, an arrangement which is intermediate between the two. The structures are discussed from the viewpoint of indirect exchange. Magnetic susceptibilities, obtained by the Gouy method, are reported for all three compounds. (auth)

22483

EFFECTS OF NEUTRON AND GAMMA-RAY IRRADIA-

TION ON THE DIELECTRIC CONSTANT AND LOSS TANGENT OF SOME PLASTIC MATERIALS. R. A. Weeks and D. Binder (Oak Ridge National Lab., Tenn.). Power App. and Systems, 7p.(1959) Apr.

It is necessary to consider each material of interest as a dielectric individually when the additional environmental factor of strong radiation fields is present. In some applications, the deterioration of the mechanical properties will be a limiting factor, as in Teflon, for example. In others the limiting factor will be the alteration of the electrical properties. In terms of two of the most widely used dielectrics, polyethylene and polystyrene, the latter is superior both electrically and mechanically when the total integrated dose does not exceed 10^{20} fast neutrons/cm^2. The polyethylene will serve very well in many applications. They represent the long lifetime effects of the radiation on the electrical properties considered. They say nothing about the transient effects arising from the short-lifetime ionization processes. These are exhibited in one form by the large increase in the d-c conductivity while in the radiation field, but which recover when the radiation is removed. The effects on the a-c electromagnetic properties under similar radiation conditions have not yet been studied in any detail. Since the ionization products are electrons and free radicals, it might be expected the electromagnetic effects of these entities to show up in the absorption of energy in the microwave or visible light region of the spectrum. (auth)

22484

ELECTRIC-ARC SMELTING OF MOLYBDENUM IN A VACUUM. A. S. Stroyev, A. M. Ivanov, and Ye. S. Ovsepyan. Primenenie. Vakuuma v Met., 62-5(1958). (Translated from Referat. Zhur. Met. No. 3, 1959, p.86).

The raw material is industrial sintered Mo in 15 x 15 mm rods. In the process of smelting under vacuum of the order of 10^{-3} mm Hg, Mo, Zr, Ti, and C are deoxidized. Nonporous ingots, without flaws in the central zone, are obtained. Owing to the relatively fine-grain structure and the sharpness of boundaries such ingots can be deformed by any method, including free forging, so long as a suitable heating and a proper degree of mechanical reduction are observed. The deformed Mo exhibits satisfactory characteristics of ductility at room temperature. (TCO)

22485

CERTAIN PROPERTIES OF CORUNDUM CERAMICS WITH ADDITIONS OF ZrO_2, Cr_2O_3, TiO_2, and MgO. D. N. Poluboyarinov and N. N. Silina. Trudy Moskov. Khim. Tekhnol. Inst. im. D. I. Mendeleyeva, No. 24, 155-63(1957). (Translated from Referat. Zhur. Met. No. 7, 1958, p.22).

Investigations were made of corundum with additions (A) of 1 to 20% ZrO_2 or Cr_2O_3, 0.5 to 5% TiO_2, and 1 to 5% MgO. The fusion temperature of all these substances except that with 20% ZrO_2 is no lower than that of pure Al_2O_3. (A) having 10% and more Cr_2O_3 or unstabilized ZrO_2 and even 1% of stabilized ZrO_2 reduces the softening temperature (ST) under load. (A) of 5% Cr_2O_3 raises the ST; (A) of 5% TiO_2 or MgO does not affect the ST. The σ_{bi} of massive refractories with (A) of 5% MgO or 10% ZrO_2 increases, as is also the case with A of 20% Cr_2O_3. On (A) of 20% ZrO_2 or 2 to 3% TiO_2, the σ_{bi} declines. The best resistance to heat is that of refractory substances with (A) of 5% ZrO_2 or 0.5% TiO_2. The minimal sintering temperature (1550°) was revealed by massive refractories with 0.5 to 1% TiO_2(A).

22486

THE EFFECT OF PHOSPHORUS CONTENT ON THE NOTCH TOUGHNESS OF Cr–Ni AND Cr–Ni–Mo STEELS. V. D. Sadovskii and B. K. Sokolov. Trudy Ural'. Politekh. Inst. im. S. M. Kirova, No. 68, 45-53 (1958).

The effect of P content on the a_k values of two types of steel was investigated after quenching and tempering at various temperatures. The composition of the steel was as follows: 0.25 to 0.27% C, 0.26 to 0.32% Si, 0.40 to 0.51% Mn, 2.91 to 3.1% Cr, 1.00 to 1.06% Ni, and 0.024 to 0.110% P; and 0.27 to 0.28% C, 0.21 to 0.33% Si, 0.39 to 0.43% Mn, 2.95 to 3.06% Cr, 0.98 to 1.04% Ni, 0.35 to 0.42% Mo, and 0.022 to 0.160% P. It was established that as the P content of these steels is increased, and over-all reduction in the value of a_k is observed after tempering at temperatures ranging from 20 to 675°C. This is accompanied by an increase in the susceptibility to temper brittleness (TB) and a reduction in the value of a_k during additional low tempering after refining anneal. The adverse influence of P on the a_k value is attributable to the fact that P aggravates the susceptibility of the steels to reverse TB and, as its concentration is increased, extends the temperature range of TB down to room temperature. (TCO)

22487

THERMODYNAMIC THEORY OF RELAXATION PHENOMENA IN BINARY SOLID SOLUTIONS. O. S. Zdorovets (Dnepropetrousk Metallurgical Inst.). Ukrain. Fiz. Zhur. 4, 201-6(1959) Mar.-Apr. (In Ukrainian)

Straining of a solid solution with finite velocity leads to a non-equilibrium state. The non-equilibrium state of a solid solution is characterized by its strain tensor values, temperature, concentration, and also by the internal parameter-relaxation tensor. When the system approaches the state of static equilibrium, the relaxation tensor tends to some equilibrium value which is the function of the strain, temperature, and concentration. An expression is obtained for the free energy of the strained solid solution with finite velocity from which the values of the stress tensor and concentration change is determined for any amount of the isothermally strained solid solution. The stress and concentration change in the given solid solution sphere at a definite moment depends upon the value of the strain at that place and time and also upon the previous straining and the concentration change. The value of the elastic aftereffect which also depends, apart from the strain tensor, upon the straining rate is determined as well. (auth)

22488

ON THE DETERMINATION OF THE DISLOCATION DENSITY IN STRAINED METALS FROM MICROHARDNESS MEASUREMENTS. S. D. Hertsriken and M. M. Movikov (Kiev State Univ.). Ukrain. Fiz. Zhur. 4, 247-53(1959) Mar.-Apr. (In Ukrainian)

An attempt is made to establish a connection between the value of the interaction dislocation stress and the value of the tensile strength of the material and on the basis of this connection to compute the dislocation density in the metal at a given strain. Since the tensile strength of the sample is connected with its hardness, it was found possible to compute the dislocation density in the strained sample from the value of its hardness. The dislocation densities were calculated for aluminum, copper, silver, and nickel at various degrees of strain by torsion. The dislocation density values obtained are compared with those computed from dilatometric meas-

urements. The difference in the dislocation density values obtained by various methods is allowable in determinations of the dislocation density. By applying the data in the literature on the change in the hardness of aluminum and copper depending on the degree of compressive strain, the values of the dislocation densities in these metals were computed. In these cases too, reasonable values were obtained for the dislocation density. (auth)

22489

A STUDY OF THE CHARACTERISTIC ABSORPTION OF X-RAYS IN BINARY ALLOYS OF IRON WITH NICKEL, COBALT AND CHROMIUM. L. G. Nikolaeva and S. M. Karal'nik (Shevchenka Kiev State Univ.). Ukrain Fiz. Zhur. 4, 260-7(1959) Mar.-Apr. (In Ukrainian)

The roentgenospectral method of studying alloys has the advantage over other methods in that it permits the obtention of information on the state of the atoms of each component and not only on the state and properties of the alloy as a whole. A study was made of the change in position in the energy scale of the K edge of absorption of iron, nickel, chromium, and cobalt in the three alloy systems. It was established that the maximum changes in the K-edge position occur (approximately) in the concentration regions where extremal values of other physical properties are noted. An attempt is made to interpret the results by taking into consideration the changes in external screening during change in the nature of the interatomic bond. An inference is advanced as to the possible connection between Kunzel's rules for x-ray spectra and Wägerd's rules for change in the lattice parameter during alloying. Considerations are given as to the state of iron and chromium atoms on being alloyed in the σ-phase state. (auth)

22490

PARAMETRIC METHODS FOR DETERMINING THE ENDURANCE OF HEAT-RESISTANT ALLOYS. L. Ya. Liberman. Zavodskaya Lab. 24, 1501-9(1958).

In recent years parametric methods of determination have found an ever increasing applicability in testing and interpreting experimental results on endurance. Most used is the parametric function between time, temperature, and tension. Experiments were conducted to establish that the energy of activation Q and the time τ are dependent on the tension. Research by other workers is summarized. (TCO)

22491

ON THE METHODOLOGY OF RELATIVE MEASUREMENTS OF THE RADIOACTIVITY OF METAL AND SLAG SAMPLES. B. I. Bruk. Zavodskaya Lab. 25, 184-5(1959).

In relative radioactivity measurements the effects of the composition and density of metals and slags on the β-radiation must be considered. The method of determining this correction coefficient with radiations of the isotope S^{35} is described. The low-carbon-content steels, stainless austenite steel, acid silicate slags, basic calcareous slags (appr. 70% CaO) and a slag consisting of 30% CaO, 16% SiO_2, 14% Al_2O_3, 9% MgO, 22% Fe_2O_3, and 9% Cr_2O_3 were used as samples. The correction coefficient ranges from 1.28 to 1.37. Investigations of powdered samples showed that the radiation properties of compact and powdered samples of the same composition are different. The same is true of the differences in the absorption and dispersion of the radiation. The radiation intensity of powdered samples depends not only on the density of the sample but also on the atomic number of the element. (TCO)

22492

THE EFFECT OF IONIZING RADIATION ON THE CORROSION OF METALS UNDER ATMOSPHERIC CONDITIONS. A. V. Byalobzheskiĭ (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Fiz. Khim. 33, 1256-62(1959) June. (In Russian)

It was demonstrated experimentally that fast electrons, x rays, and γ rays at intensities corresponding to energy absorption of not less than 10^{14} ev/liter air lead to a multiple increase in the rate of corrosion of iron, copper, zinc, and aluminum in a moist atmosphere. This is the result of the appearance in the atmosphere of radiochemical reaction products such as long living O_3, H_2O_2, and N_2O_5 and especially short living HO_2, OH, NO_3, etc. Being active cathodic depolarizers, these products intensify the work of the corrosion microcouple. The usually inert nitrogen under conditions of irradiation in the presence of oxygen and moisture becomes an active corrosion agent, facilitating the formation of nitric acid. (auth)

22493

EFFECT OF DIFFERENTIAL AERATION AND OF THE pH ON THE CORROSION OF STAINLESS STEEL IN NARROW CREVICES. I. B. Ulanovskiĭ and Yu. M. Korovin (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Fiz. Khim. 33, 1413-17(1959) June. (In Russian)

A drop in oxygen concentration in a narrow crevice will, in every case, activate the surface of stainless steel, leading to the formation of a differential aeration couple. However, at normal pH values the current in such couples will quickly diminish, evidently owing to passivation of the anode. The value of the pH is one of the main factors determining the intensity of corrosion in the crevice of a metal. In some cases a low pH value will activate the metal surface in a crevice, often leading to intensive destruction due to the formation of strong galvanic couples. In other cases such an effect is not observed. (auth)

22494

STABILITY AND STABILIZATION CONDITIONS OF ZrO_2. L. P. Kochalova and A. I. Avgustinik. Zhur. Prikladnoĭ Khim. 32, 1451-7(1959) July. (In Russian)

The stability of cubic structure solid solutions of ZrO—CaO depends on the phase composition. Partial solid solution decomposition occurs in specimens with cubic and monoclinic ZrO_2 structure. Secondary formations of ZrO_2—CaO solid solutions with cubic structure appear at temperatures of 1800 to 1900°. (R.V.J.)

22495

PREPARATION OF POWDERED NICKEL ALLOYS WITH IRON AND MOLYBDENUM BY OXIDE FUSION. G. A. Semenov. Zhur. Prikladnoĭ Khim. 32, 1502-5(1959) July. (In Russian)

Preparation of powder-like nickel base alloys by the fusion of nickel and iron oxides and molybdenum trioxide was studied for determining the conditions affecting the oxide fusion reaction, the intermetallic oxides, the granularity of powders, and their oxygen content. The studies were carried out with NIMO-20 (60% Ni, 20% Mo, and 20% Fe) and NIMO-30 (65% Ni, 30% Mo, and 5% Fe) at 600 to 900°C. (R.V.J.)

22496

PREPARATION OF Cr_7C_3. T. Ya. Kosolapova and G. V. Samsonov (Kiev Inst. of Metal Ceramics and Spe-

cial Alloys). Zhur. Prikladnoĭ Khim. 32, 1505-9(1959) July. (In Russian)

Various stages in the preparation of pure single-phase Cr_7C_3 are analyzed. (R.V.J.)

22497

STUDIES OF LOCAL AND GENERAL CORROSION OF AUSTENITIC CHROMIUM-NICKEL STEEL DURING THERMAL TREATMENT AND ETCHING. A. V. Shreiderder, E. M. Kontsevaya, and V. P. Gamazov. Zhur. Prikladnoĭ Khim. 32, 1509-15(1959) July. (In Russian)

Corrosion and etching tests were made on austenite steels 0X18H9 (0.06% C, 17.0% Cr, 0.20% Mn, 8.5% Ni, 0.035% P, 0.020% S, and 0.80% Si), 1X18H9 (0.15% C, 18.3% Cr, 0.2% Mn, 8.8% Ni, 0.030% P, 0.025% S, and 0.8% Si), 1X13H4G9 (0.25% C, 16.7% Cr, 7.4% Mn, 4.3% Ni, 0.03% P, 0.025% S, and 0.33% Si), and heat resisting nickel-chromium alloy (0.11% C, 20.0% Cr, 0.45% Fe, 0.8% Mn, 78.0% Ni, 0.015% P, 0.010% S, 0.81% Si, and 0.15% Ti) at elevated temperatures. (R.V.J.)

22498

REACTOR CORE MATERIALS. Technical Progress Reviews, Vol. 2, No. 3. Columbus, Ohio, Battelle Memorial Institute, 1959. 58p. $0.55(GPO) domestic; $0.70 foreign.

This volume is divided into five sections. Section one is devoted to fuels and fertile materials and includes unalloyed U, alpha-U alloys, gamma-phase alloys, epsilon-phase alloys, dilute U alloys, Pu and alloys, Th and alloys, dispersion fuel materials, refractory fuel and fertile materials, diffusion studies, mechanism of corrosion of fuel alloys, and basic studies of radiation effects in fuel materials. The second section on moderator materials includes graphite, Be metal and alloys, Be compounds, and solid hydrides. The third section discusses nuclear poisons. The fourth section is devoted to cladding and structural materials and includes corrosion radiation effects in nonfuel materials, selected metallurgical aspects of cladding and structural materials, and selected mechanical properties of cladding and structural materials. The last section on special fabrication techniques includes melting, casting, heat treatment, hot working, cladding, welding, brazing, and nondestructive testing. (W.L.H.)

22499

VOPROSY FIZIKI METALLOV I METALLOVEDENIYA. (Problems in Metal Physics and Metal Studies). Kiev, Academy of Sciences, Ukrainian SSR, 1959. 211p.

The symposium contains data on the effects of fast rate heating, thermal treatment, deformation and condition of crystal phase transformation, fine structure and properties of metals and alloys, effects of alloying on the volume and intergrain diffusion in alloys as well as the effects of multiple annealing and electromagnetic and ultrasonic radiation effects on physical properties. The book is designed for scientists, personnel, working in metal physics, and advanced students of physics and metallurgy. (R.V.J.)

22500

MANUFACTURE OF CLAD FUEL ELEMENT. (to Atomic Energy of Canada, Ltd.). British Patent 816,919. July 22, 1959.

Pressure-bonding Al-clad fuel elements are described. The fuel is placed in an Al sheath and an Al plug is inserted in the end. The plug-end is fixed in a die, heated to 800°F and pressed at 30,000 psi to bond plug to sheath. (T.R.H.)

22501

IMPROVEMENTS IN OR RELATING TO CASTING OF METAL SURFACES. Alan Blainey and Michael Lesney Noakes (to United Kingdom Atomic Energy Authority). British Patent 820,614. Sept. 23, 1959.

A method is given for applying Zr or Zr-rich erosion-resistant coatings to materials for use at 900°C. In one example a mixture of xylene, methanol, and ZrH_4 was prepared and sprayed on Nimonic 80 alloy which had been previously etched in HNO_3 and HCl. The sprayed body was then dried at 100°C 1 hr, placed on an alumina boat in a tube and the tube evacuated. The tube is then filled with H_2 and heated to 1100°C for 15 min. A substantially uniform brown coating was obtained. (T.R.H.)

22502

IMPROVEMENTS IN OR RELATING TO CERMETS COMPRISING URANIUM AND URANIUM CARBIDE. Jack Williams (to United Kingdom Atomic Energy Authority). British Patent 821,287. Oct. 7, 1959.

The preparation of U-UC cermets is described. Powdered U and C are mixed and sintered in inert atmosphere. In one example, a cermet containing 83.3 wt.% UC was prepared starting with 4 wt.% graphite. The mixture was compacted at 750°C and 15 tons/in.^{2} and sintered in vacuum at 1100°C. (T.R.H.)

22503

METHOD OF MAKING ALLOYS OF BERYLLIUM WITH PLUTONIUM AND THE LIKE. O. J. C. Runnals (to U. S. Atomic Energy Commission). U. S. Patent 2,875,041. Feb. 24, 1959.

The production of alloys of beryllium with one or more of the metals uranium, plutonium, actinium, americium, curium, thorium, and cerium is described. A halide salt of the metal to be alloyed with the beryllium is heated at 1300°C in the presence of beryllium to reduce the halide to metal and cause the latter to alloy directly with the beryllium. Although the heavy metal halides are more stable, thermodynamically, than the beryllium halides, the reducing reaction proceeds to completion if the beryllium halide product is continuously removed by vacuum distillation.

22504

METHOD AND COATING COMPOSITION FOR PROTECTING AND DECONTAMINATING SURFACES. D. C. Overhold and M. D. Peterson (to U. S. Atomic Energy Commission). U. S. Patent 2,877,131. Mar. 10, 1959.

A protective coating useful in the decontamination of surfaces exposed to radioactive substances is described. This coating is placed on the surface before use and is soluble in water, allowing its easy removal in the event decontamination becomes necessary. Suitable coating compositions may be prepared by mixing a water soluble carbohydrate such as sucrose or dextrin, together with a hygroscopic agent such as calcium chloride or zinc chloride.

22505

LIQUID METAL COMPOSITIONS CONTAINING URANIUM. R. J. Teitel (to U. S. Atomic Energy Commission). U. S. Patent 2,883,330. Apr. 21, 1959.

Liquid metal compositions containing a solid uranium compound dispersed therein is described. Uranium combines with tin to form the intermetallic compound USn_3. It has been found that this compound may be incorporated into a liquid bath containing bismuth and

lead-bismuth components, if a relatively small percentage of tin is also included in the bath. The composition has a low thermal neutron cross section which makes it suitable for use in a liquid metal fueled nuclear reactor.

22506

METHOD OF ELECTROPLATING ON URANIUM. E. W. Rebol and R. F. Wehrmann (to U. S. Atomic Energy Commission). U. S. Patent 2,884,364. Apr. 28, 1959.

This patent relates to a preparation of metallic uranium surfaces for receiving coatings, particularly in order to secure adherent electroplated coatings upon uranium metal. In accordance with the invention the uranium surface is pretreated by degreasing in trichloroethylene, followed by immersion in 25 to 50% nitric acid for several minutes, and then rinsed with running water, prior to pickling in trichloroacetic acid. The last treatment is best accomplished by making the uranium the anode in an aqueous solution of 50 per cent by weight trichloroacetic acid until work-distorted crystals or oxide present on the metal surface have been removed and the basic crystalline structure of the base metal has been exposed. Following these initial steps the metallic uranium is rinsed in dilute nitric acid and then electroplated with nickel. Adherent firmly-bonded coatings of nickel are obtained.

22507

NON-AQUEOUS DISSOLUTION OF MASSIVE PLUTONIUM. J. G. Reavis, J. A. Leary, and K. A. Walsh (to U. S. Atomic Energy Commission). U. S. Patent 2,886,410. May 12, 1959.

A method is presented for obtaining non-aqueous solutions of plutonium from massive forms of the metal. In the present invention massive plutonium is added to a salt melt consisting of 10 to 40 weight per cent of sodium chloride and the balance zinc chloride. The plutonium reacts at about 800°C with the zinc chloride to form a salt bath of plutonium trichloride, sodium chloride, and metallic zinc. The zinc is separated from the salt melt by forcing the molten mixture through a Pyrex filter.

22508

METHOD FOR THE REDUCTION OF URANIUM COMPOUNDS. W. H. Cooke and J. W. C. Crawford (to U. S. Atomic Energy Commission). U. S. Patent 2,886,429. May 12, 1959.

An improved technique of preparing massive metallic uranium by the reaction at elevated temperature between an excess of alkali in alkaline earth metal and a uranium halide, such as uranium tetrafluoride is presented. The improvement comprises employing a reducing atmosphere of hydrogen or the like, such as coal gas, in the vessel during the reduction stage and then replacing the reducing atmosphere with argon gas prior to cooling to ambient temperature.

22509

URANIUM COMPOSITIONS. N. P. Allen and J. D. Grogan (to U. S. Atomic Energy Commission). U. S. Patent 2,886,430. May 12, 1959.

This patent relates to high purity uranium alloys characterized by improved stability to thermal cycling and low thermal neutron absorption. The high purity uranium alloy contains less than 0.1 per cent by weight in total amount of any ore or more of the elements such as aluminum, silicon, phosphorous, tin, lead, bismuth, niobium, and zinc.

22510

VANADIUM ALLOYS. Karl F. Smith and Ray J. Van Thyne (to U. S. Atomic Energy Commission). U. S. Patent 2,886,431. May 12, 1959.

This patent deals with vanadium based ternary alloys useful as fuel element jackets. According to the invention the ternary vanadium alloys, prepared in an arc furnace, contain from 2.5 to 15% by weight titanium and from 0.5 to 10% by weight niobium. Characteristics of these alloys are good thermal conductivity, low neutron capture cross section, good corrosion resistance, good welding and fabricating properties, low expansion coefficient, and high strength.

22511

PRODUCTION OF SHEET FROM PARTICULATE MATERIAL. A. Blainey (to U. S. Atomic Energy Commission). U. S. Patent 2,886,433. May 12, 1959.

A process is presented for forming coherent sheet material from particulate material such as granular or powdered metal, granular or powdered oxide, slurries, pastes, and plastic mixes which cohere under pressure. The primary object is to avoid the use of expensive and/or short lived pressing tools, that is, dies and specially profiled rolls, and so to reduce the cost of the product and to provide in a simple manner for the making of the product in a variety of shapes or sizes. The sheet material is formed when the particulate material is laterally confined in a boundary material deformable in all lateral directions under axial pressure and then axially compressing the layer of particulate material together with the boundary material.

22512

NICKEL PLATING PROCESS. Thomas B. Hoover and Thomas E. Zava (to U. S. Atomic Energy Commission). U. S. Patent 2,886,468. May 12, 1959.

A simplified process is presented for plating nickel by the vapor decomposition of nickel carbonyl. In a preferred form of the invention a solid surface is nickel plated by subjecting the surface to contact with a mixture containing by volume approximately 20% nickel carbonyl vapor, 2% hydrogen sulfide and .1% water vapor or 1% oxygen and the remainder carbon dioxide at room temperature until the desired thickness of nickel is obtained. The advantage of this composition over others is that the normally explosive nickel carbonyl is greatly stabilized.

22513

PLUTONIUM–CERIUM–COPPER ALLOYS. A. S. Coffinberry (to U. S. Atomic Energy Commission). U. S. Patent 2,886,504. May 12, 1959.

A low melting point plutonium alloy useful as fuel in a homogeneous liquid metal fueled nuclear reactor is described. Vessels of tungsten or tantalum are useful to contain the alloy which consists essentially of from 10 to 30 atomic per cent copper and the balance plutonium and cerium, with the plutonium not in excess of 50 atomic per cent.

22514

VARIABLE TIME-INTERVAL GENERATOR. J. E. Gross (to U. S. Atomic Energy Commission). U. S. Patent 2,886,775. May 12, 1959.

This patent relates to a pulse generator and more particularly to a time interval generator wherein the time interval between pulses is precisely determined. The variable time generator comprises two oscillators with one having a variable frequency output and the other a fixed frequency output. A frequency divider is

connected to the variable oscillator for dividing its frequency by a selected factor and a counter is used for counting the periods of the fixed oscillator occurring during a cycle of the divided frequency of the variable oscillator. This defines the period of the variable oscillator in terms of that of the fixed oscillator. A circuit is provided for selecting as a time interval a predetermined number of periods of the variable oscillator. The output of the generator consists of a first pulse produced by a trigger circuit at the start of the time interval and a second pulse marking the end of the time interval produced by the same trigger circuit.

22515

METHOD OF CLEANING METAL SURFACES. H. W. Winkler, J. W. Morfitt, and T. H. Little (to U. S. Atomic Energy Commission). U. S. Patent 2,887,373. May 19, 1959.

Cleaning fluids for removing deposits from metal surfaces are described. The cleaning agents of the invention consist of aqueous nitric acid and an anhydrous nitrate salt of a metal which is lower in the electromotive series than the element of the deposit to be removed. In general, the salt content of the cleaning agents ranged from 10 to 90%, preferably from 10 to 40% by weight; and the balance of the composition comprises nitric acid of any strength from extremely dilute up to concentrated strength.

22516

BORON NITRIDE-METAL CARBIDE BODIES AND THE MANUFACTURE THEREOF. Kenneth M. Taylor (to The Carborundum Co.). U. S. Patent 2,888,355. May 26, 1959.

Refractory materials made of metal carbide particles bonded by boron nitride are described. In one example TiC was ground in a ball mill 16 hrs to 10μ and finer. After treatment in a 1:3 HCl–water solution it was washed with water and dried at 110°C. The TiC was mixed with BN then, in a mortar and pestle. The raw mix was placed in a graphite mold with plungers and heated at 1600°C until no further motion of the plungers was evident. A sandblast penetration hardness of 0.092 in. was found compared to 0.01 for glass. A similar method was used to prepare a BN–WC body. (T.R.H.)

22517

INTERNAL CUTTING DEVICE. W. H. Russell, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,892,387. June 30, 1959.

A device is described for removing material from the interior of a hollow workpiece so as to form a true spherical internal surface in a workpiece, or to cut radial slots of an adjustable constant depth in an already established spherical internal surface. This is accomplished by a spring loaded cutting tool adapted to move axially wherein the entire force urging the tool against the workpiece is derived from the spring. Further features of importance involve the provision of a seal between the workpiece and the cutting device and a suction device for carrying away particles of removed material.

22518

A HEAT-RESISTANT MAGNESIUM ALLOY. I. G. Kovalev, T. V. Lebedeva, I. M. Mikheyev, and V. V. Dolgov. U.S.S.R. Patent 111185. Byull. Izobret., 1958, No. 4.

A heat resistant magnesium alloy is described which contains 1.0 to 2.5% manganese and 1 to 5% neodymium. The Nd improves the mechanical properties of the alloy at high temperatures. (TCO)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

22519 CERN-59-30

European Organization for Nuclear Research, Geneva.

ON THE FAST EXTRACTION OF PARTICLES FROM A 25 GEV PROTON SYNCHROTRON. B. Kuiper and G. Plass. Aug. 24, 1959. 56p.

The requirements of a fast beam extraction system and some possible ways to achieve a fast magnetic field pulse are analyzed. A proposal for the realization of a fast beam extractor for the CERN proton synchrotron is presented. (auth)

22520 DESY-A2.49

Deutsches Elektronen-Synchrotron, Hamburg.

DIE FORM DER ZIELMARKEN FÜR DIE VERMESSUNGSARBEITEN BEI DESY. (The Shape of the Target Mark for Measurements in DESY.) K. Marfahn. Aug. 10, 1959. 5p.

The measurements in DESY at gaps and lines of sight between 2.5 and 50 m should be guaranteed positional accuracy up to ± 0.1 mm. A principle problem in the attainment of this tolerance is the accurate centering of the theodolite, the target mark, and the index line for invarband measurements. The target marks investigated, the experimental set-up, and the results obtained for DESY are reported. (J.S.R.)

22521 MURA-498

Midwestern Universities Research Assn., Madison, Wis.

THEORY OF THE FIXED FREQUENCY CYCLOTRON. George Parzen. Aug. 18, 1959. 5p. Contract AT(11-1)-384. $0.50(OTS).

The results previously found for the linear orbit properties of an accelerator with a general magnetic field are applied to the fixed frequency cyclotron. The results of the theory are tested by applying them to the Berkeley cyclotron model. (auth)

22522 UCRL-8690

California. Univ., Livermore. Lawrence Radiation Lab.

ION-SOURCE POSITIONER. Roy F. Burton, W. Barclay Jones, and Charles A. Corum. Apr. 1959. 5p. Contract W-7405-eng-48. $0.50(OTS).

With this device an adjustment can be made of the ion source inside the vacuum chamber of the 60-in. cyclotron in order to obtain maximum beam current. For in-out movement, a worm-driven screw slides the ion source shaft through a supporting seal plate. For left-right and up-down movement a horizontal slide plate in a vertical slide frame is used. The movements of the ion source obtained with this mechanism are 1.250-in. of total travel in-out and left-right; and 0.750-in. up-down. (W.L.H.)

22523 UCRL-8828

California. Univ., Berkeley. Lawrence Radiation Lab.

THE BEAM-CONTROLLED FREQUENCY-CORRECTION SYSTEM OF THE BEVATRON. Harry G. Heard. July 1, 1959. 19p. Contract W-7405-eng-48. $0.75 (OTS).

A transistorized tracking system is described that generates the signals necessary to control the radial

position of the proton beam of the Bevatron. The source of frequency-correcting signal may be either an analog computer or a radial-position discriminator that derives signals from the beam itself. Provision is made to switch from one tracking-signal source to the other at the instant the two voltage sources have equal values. The system will track the proton beam at all levels of beam intensity and may be used in conjunction with pulsed auxiliary magnet windings to extend the injection time of the accelerator, thereby increasing the over-all intensity of the beam. The advantages of automatic beam tracking are obtained without a sacrifice in operational flexibility. (auth)

22524 CEA-tr-R-708

UTILISATION DE MICROSCOPE ÉLECTRONIQUE POUR L'ANALYSE MICROCHIMIQUE. (Utilization of the Electron Microscope for Microchemical Analysis.) L. I. Zemlyanova (Zemlianova) and Yu. (Iou.) M. Kuchnir (Kouchnir). Translated into French by M. Lopoukhine and B. de Trezvinsky from Zavodskaya Lab. 23, 1083-7(1957). 12p.

A microcrystallochemical analysis of Co, Zn, Cd, Mg, and SO_4 ions using an electron microscope is reported. The method of detection of the ions when they are present simultaneously in solution is described, as well as the method for detection of small additions of ions to concentrated solutions of Zn and Cd. By combining direct and indirect methods of analysis of microcrystals, a system of microcrystalloscopic analysis using the electron microscope was developed for solid phases of complex alloys. (T.R.H.)

22525 CERN-59-29

THE CERN PROTON SYNCHROTRON (PART 1). (Le Synchrotron à Protons du CERN). E. Regenstreif. Translated by P. C. P. Mollet from report CERN-58-6a. 238p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 245.

22526

THE ELECTROSTATIC ACCELERATORS OF CHARGED PARTICLES. V. N. Glazanov. Atomnaya Energ. 6, 174-86(1959) Feb. (In Russian)

Problems and means for increasing particle energy and beam strength in electrostatic generators are discussed. Comparisons are made of various intensity stabilization methods and various types of cascade generators producing high-power beams are described. (tr-auth)

22527

STEREOTRON—THE BETATRON WITH A SPACE EQUILIBRIUM ORBIT. B. N. Rodimov. Atomnaya Energ. 6, 200-2(1959) Feb. (In Russian)

A design is given of a constant-field stereotron in which accelerated electrons move into stronger fields without increasing the radius of trajectory. (R.V.J.)

22528

AN APPLICATION OF NON-UNIFORM ELECTRIC FIELD FOR CHARGE PARTICLES OUTLET FROM CYCLOTRON. A. A. Aizumanov and E. S. Mironov. Atomnaya Energ. 6, 202-3(1959) Feb. (In Russian)

Descriptions are given of an extraction system with a non-uniform field where the current losses and the beam convergence angle are small and the beam divergence is uniform. (R.V.J.)

22529

PARTICLE ACCELERATORS — CLASSIFICATION AND SURVEY. Günter Lehr (Bundesministerium fur Atomkernenergie und Wasserwirtschaft, Godesberg, Ger.). Atomwirtschaft 4, 277-88(1959) July-Aug. (In German)

The types of particle accelerators—the cascade generator, Van de Graaff, generator, linear accelerator, cyclotron, synchrocyclotron, synchrotron, betatron, AG accelerator, and plasma accelerator—are briefly described. The principal accelerators of the world are tabulated. (J.S.R.)

22530

COST FACTORS IN ACCELERATOR CONSTRUCTION. Günter Lehr (Bundesministerium fur Atomkernenergie und Wasserwirtschaft, Godesberg, Ger.). Atomwirtschaft 4 289(1959) July-Aug. (In German)

The factors which influence the cost of an accelerator, such as the magnet and auxiliaries, the focusing principle used, and the power supply, are briefly considered. The effects on the cost are illustrated by a tabulation of the costs of various accelerators. (J.S.R.)

22531

PARTICLE ACCELERATION AND THERMONUCLEAR FUSION. H. Neu (AEG-Forschungsinstitut, Frankfurt am Main). Atomwirtschaft 4, 290-2(1959) July-Aug. (In German)

Particle injection into some fusion reactors is accomplished by means of particle accelerators. The DCX and the OGRA experimental fusion reactors are discussed as examples of this utilization of accelerators. The theory of thermonuclear reactions is briefly described. (J.S.R.)

22532

THE HEIDELBERG CYCLOTRON. U. Schmidt-Rohr (Max-Planck-Institut fur Kernphysik, Heidelberg, Ger.). Atomwirtschaft 4, 293-6(1959) July-Aug. (In German)

The Heidelberg 12-Mev deuteron cyclotron is briefly described. Its chamber has a one-dee system. The vacuum system, the high-frequency installation, the ion source and beam intensity, the cyclotron beam, radiation protection, and building and operating costs are considered. The essential parameters are tabulated. (J.S.R.)

22533

THE SYNCHROCYCLOTRON AT BONN UNIVERSITY. Wolfgang Riezler (Universität, Bonn). Atomwirtschaft 4, 296-9(1959) July-Aug. (In German)

The 31-Mev deuteron synchrocyclotron at Bonn University is briefly described. A brief review is given of the synchrocyclotron principle. The magnet, vacuum chamber, ion source, high-frequency system, modulator, control installation, and the construction are considered. (J.S.R.)

22534

THE 500-Mev ELECTRON SYNCHROTRON IN BONN. H. Ehrenberg and W. Paul (Universität, Bonn). Atomwirtschaft 4, 300-3(1959) July-Aug. (In German)

The 500-Mev electron synchrotron in Bonn is briefly described. It has an AG focusing system with preacceleration by a Van de Graaff generator. The parameters of the instrument are tabulated. (J.S.R.)

22535

VAN DE GRAAFF ACCELERATOR FOR RESEARCH. Günter Busch (Universität, Freiburg i. B.). Atomwirtschaft 4, 303-6(1959) July-Aug. (In German)

The principle of operation of the Van de Graaff generator is briefly discussed. Production of the direct-current voltage potential, production and acceleration of

the charged particles, and measurement and control of the ion beam are described. The uses of the Van de Graaff generator are briefly indicated. The tandem (two-stage) Van de Graaff is also discussed. (J.S.R.)

22536

THE GERMAN ELECTRON SYNCHROTRON (DESY) IN HAMBURG. O. Beer, W. Jentschke, K. A. Steffen, and H.-O. Wüster (Deutsches Elektronen-Synchrotron, Hamburg). Atomwirtschaft 4, 307-12(1959) July-Aug. (In German)

The basic principles in the design and construction of the 6-Bev DESY electron synchrotron are discussed. The planned research facilities are also considered. (J.S.R.)

22537

BUILDING DESIGN FOR ACCELERATORS. O. Beer (Deutsches Elektronen-Synchrotron, Hamburg). Atomwirtschaft 4, 317-22(1959) July-Aug. (In German)

The buildings necessary for the operation and experimental use of accelerators are discussed. The lay-out of the accelerator building is illustrated. Foundation problems for the larger installations are also considered. The individual problems in construction planning are described, using DESY as an example. (J.S.R.)

22538

VACUUM INSTALLATIONS IN PARTICLE ACCELERATORS. K. H. Mirgel. Atomwirtschaft 4, 323-8(1959) July-Aug. (In German)

The requirements for the construction of the vacuum chamber of an accelerator are described. The problems which must be solved include air tightness, behavior of materials under irradiation, valves, packing materials, vacuum production, vacuum pumps, return of pumped media into the receiver, and control and safety of the vacuum installation. (J.S.R.)

22539

HIGH FREQUENCY INSTALLATIONS FOR PARTICLE ACCELERATORS. V. H. Schmitter (Max-Planck-Institut für Physik und Astrophysik, Munich). Atomwirtschaft 4, 329-33(1959) July-Aug. (In German)

A fixed frequency system and a frequency modulated system used for particle accelerators are described. A brief survey is given of the fixed frequency system in a proton linear accelerator and of the frequency modulated system in a synchrocyclotron. (J.S.R.)

22540

POWER SUPPLY FOR PARTICLE ACCELERATORS. W. Bothe (Deutsches Elektronen-Synchrotron, Hamburg). Atomwirtschaft 4, 333-7(1959) July-Aug. (In German)

The energy supply of particle accelerators present special problems since a large amount of power must be supplied from transformers and special networks with definite wave forms or with definite time constants. These problems are discussed for the synchrocyclotron, the linear accelerator, and the synchrotron. (J.S.R.)

22541

MAGNETS FOR PARTICLE ACCELERATORS. Gerhard Meister (Universität, Bonn). Atomwirtschaft 4, 338-40 (1959) July-Aug. (In German)

The requirements and construction problems of cyclotron and synchrotron magnets are described. The dimensions, materials, cost, manufacture, and assembly are considered for the cyclotron magnet, and the manufacture and assembly, magnet windings, and tolerances are discussed for the synchrotron magnet. The DESY magnets are used as an example. (J.S.R.)

22542

THE PLASMA ACCELERATOR. Martin Deutschmann (Physikalisches Institut der Technischen Hochschule, Aachen). Atomwirtschaft 4, 343-4(1959) July-Aug. (In German)

The plasma accelerator is, as yet, only in the theoretical stage. A brief survey is presented of the possibilities of such a machine, the practical problems to be solved for its realization, and the work which is being done on these problems. The Aachen plasma betatron is briefly discussed. (J.S.R.)

22543

PLANNING AND PRE-DEVELOPMENT OF THE KARLRUHE RELATIVISTIC ISOCHRONOUS CYCLOTRON. K. Steimel and A. Lerbs (AEG Allgemeine Elektricitäts-Gesellschaft, Frankfurt am Main). Atomwirtschaft 4 345-8(1959) July-Aug. (In German)

The basic concepts of a relativistic isochronous cyclotron are briefly discussed. The Karlsruhe machine is being planned for an output of 50-Mev deuterons. The Thomas focusing principle with azimuthally varying magnetic field will be used. An accelerating mechanism which requires no additional gap height above the particle orbit is planned. (J.S.R.)

22544

ON THE QUANTUM INTERACTION OF AN ELECTRON WITH THE ACCELERATING ELECTRIC FIELD IN A SYNCHROTRON. I. M. Ternov. Izvest. Vysshikh Ucheb. Zavedenii, Fiz., No. 6, 123-9(1958).

A quantum-mechanical discussion is given on the energy absorbed by an electron when it passes through the accelerating gap in a synchrotron. In a synchrotron an electron experiences a high-frequency electric field (in addition to the magnetic field) and the direction of the electric field is tangential to the electron path. The electric field is localized in one or a few accelerating gaps and the electron increases its energy on passing through these gaps. The electric field compensates radiational losses of the electron and this compensation takes place in jumps during the instant of passage of the electron through the accelerating gap. The process of energy absorption by the electron is discussed from the point of view of quantum transitions. Only terms linear in the electric field are retained and the interaction of the electron with the electric field is looked upon as a perturbation introduced into the motion of the electron in the magnetic field. It is shown that the presence of the accelerating gaps has no effect upon betatron vibrations. This is not the case in the radiation process when discreteness plays an important role. (TCO)

22545

THE 2.5 MeV MICROTRON AT THE INSTITUTE OF PHYSICS OF THE NAPLES UNIVERSITY. A. A. Vorob'yev. Izvest. Vysshikh Ucheb. Zavedenii, Fiz., No. 6, 167-70(1958).

22546

OPERATING CHARACTERISTICS OF HIGH-FREQUENCY-ION SOURCES USING A DIAPHRAGM INSIDE THE EXTRACTION CHANNEL. Daniel Blanc and Andre Degeilh (Centre National de la Recherche Scientifique, Toulouse). J. phys. radium 20, Suppl. No. 7, 55A-9A(1959) July. (In French)

A high-frequency excited source, producing a positive argon ion beam is described, and its operational features, with and without a diaphragm inside its extracting channel are given. If a diaphragm of

one mm diameter is introduced when the argon pressure is 15 microns of Hg in the ionization chamber, gas consumption will be reduced in a proportion of 4:24; however, the source will produce an ion beam 60% of that obtained without a diaphragm. Optimum operating conditions are established for the same pressure; they correspond to an extracting voltage of about 5,000 volts. The value of the current obtained is a function of gas pressure in the source; the current has a maximum for 6 microns of Hg pressure without a diaphragm, and for 8 microns of Hg pressure with a diaphragm. (auth)

22547

INTRODUCTION [TO THE SATURNE PROTON SYNCHROTRON]. R. Levy-Mandel, R. Maillet, and S. D. Winter (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 428-44(1959) June. (In French)

A brief description is given of the most important elements of the Saturne proton synchrotron and the basic principles used in the selection of its parameters are indicated. The principal parameters are tabulated. (J.S.R.)

22548

CONCEPTION OF THE MAGNET OF SATURNE. G. Bronca, H. Bruck, G. Gendreau, J. Hamelin, G. Neyret, J. Parain, and M. Salvat (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 445-9 (1959) June. (In French)

The Saturne magnet has the "C" form and is theoretically divided into 288 blocks. Radius of curvature of the equilibrium orbit is 184 mm. The magnet has immovable pieces, which introduces extreme mechanical tolerances, but offers many advantages. The magnetic characteristics of the polar pieces and the coils are described. The forces acting on the magnet and coils are derived. The parameters of the magnet are tabulated. (J.S.R.)

22549

STUDY OF THE CONSTRUCTION, FABRICATION, AND MOUNTING OF THE SATURNE ELECTROMAGNET. G. Armand and J. Lutz (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 450-62(1959) June. (In French)

The studies on the construction, fabrication, and installation of the Saturne electromagnets were made theoretically, from measurements on models, and by thorough technological examinations. The general tolerances permissible, the technological tests and measurements, and the selection of materials are discussed. The structure of the yokes, polar pieces, and coils are described, and their fabrication is reviewed. The schedule for the setting up of the electromagnets is tabulated, and the instruments used for measurements and tolerances are described. (J.S.R.)

22550

MAGNETIC STUDY AND TESTING OF THE SATURNE SYNCHROTRON. G. Bronca, H. Bruck, J. Hamelin, G. Neyret, and J. Parain (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 463-72(1959) June. (In French)

Models of the Saturne Magnet were used to determine the feed characteristics, the form of the polar pieces, the correction of deformations of the field profile at high inductions, and to make reproducibility tests on certain elements of the synchrotron. The models used are described. The magnetic characteristics of the model, correction of the induction at saturation by damping gaps and by indentation of the polar pieces, the quadrant extremities, and magnetic testing of the polar pieces and the chambers are discussed. The magnetic characteristics of Saturne were verified on a section of the magnet blocks and in the cross section of the magnet. The induction, the index n, the leakage field of the quadrant extremities, and the position of the median magnetic plane were measured. (J.S.R.)

22551

THE APPARATUS FOR MAGNETIC MEASUREMENTS USED DURING THE CONSTRUCTION OF THE SACLAY SYNCHROTRON. A. Chonez, A. Gabet, E. Labois, P. Lerond, G. Rastoix, and J. Taillet (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 473-8 (1959) June. (In French)

In the construction of apparatus for magnetic measurements, emphasis was placed on rapidity and simplicity of operation, precision, and ease in reading results. The design and control of the supply systems for the scale models and the test "hexablock" were investigated simultaneously. The precision regulators and the cycling apparatus used for the models are described. Apparatus used in the static and dynamic measurements of the magnetic characteristics of the Saturne and in the measurement of the position of the median plane are reviewed. (J.S.R.)

22552

POWER SUPPLY OF THE SATURNE ELECTROMAGNET. R. Belna, P. Debraine, and P. Ricateau (Centre d'Études Nucléaires, Saclay, France) and R. Klein. Onde élec. 39, 479-86(1959) June. (In French)

The variations of power during the magnet cycling excludes a direct utilization of the grid. The power passes through an asynchronous motor, a rotor, an alternator, an auxiliary alternator, and a tachymetric alternator and feeds the magnet through the intermediary of a dodecaphase converter connected to the principal alternator. The principal characteristics of the power supply are tabulated. The methods used to protect the power supply equipment in the event of malfunction are discussed. The protection of the electromagnet is described with respect to the normal distribution of potential, transient potential distribution, and over-voltages. (J.S.R.)

22553

THE SATURNE INJECTOR. R. Vienet (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 487-92 (1959) June. (In French)

A brief description is given of the Van de Graaff accelerator which is used in the Saturne injection system. The problems in voltage behavior of the Van de Graaff, the continuous beam, and focusing are discussed in some detail. The injector characteristics are tabulated. (J.S.R.)

22554

STUDY OF THE INJECTION INTO SATURNE. G. Bronca, H. Bruck, G. Gendreau, and M. Salvat (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 492-505(1959) June. (In French)

A brief survey is given of particle motion equations and the principle of injection into a constant gradient synchrotron. The method of pulse release and the means utilized to control the beam are described. The experimental results on the measurement of n by four different methods are reported. The closed orbit in the median plane was determined theoretically and experimentally. The trajectories in the presence of malfunctions and

the trajectories resulting from corrections to the malfunctions are determined. (tr-auth)

22555

OPTICAL SYSTEM CONTROLLING THE VAN DE GRAAFF BEAM IN THE SYNCHROTRON CHAMBER. H. Bruck, G. Gendreau, M. Salvat (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 505-11 (1959) June. (In French)

The reasons leading to the selection of the achromatic and afocal optical system in the Saturne injector and the theory of this system are discussed in detail. The component parts of the optical system are described. Experimental data on the system are in good agreement with the theoretical data. (tr-auth)

22556

THE VACUUM CHAMBER OF THE SACLAY SYNCHROTRON. G. Armand, R. Le Quinio, and F. Prevot (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 512-22(1959) June. (In French)

The problems in the construction of a vacuum chamber of the magnitude needed for a proton synchrotron arise from the shape and dimensions of the chamber, the residual pressure allowable in the chamber, the magnetic, electrical, and mechanical requirements, and the necessary experimental facilities. The solutions investigated for these problems are briefly indicated, and the structure chosen is described. A brief survey of the difficulties found with respect to the general properties of the stainless and Araldite D impregnated with silica used in the construction serve as an introduction to the description of the fabrication. The pumping system is briefly considered. (J.S.R.)

22557

SATURNE ACCELERATION SYSTEM. J. Taillet (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 523-5(1959) June. (In French)

The problems in the design and construction of an acceleration system for a proton synchrotron are reviewed. The Saturne acceleration system is based on a step process, and it is divided into a low- and a high-level acceleration stage. The frequency of the low-level stage is obtained with a master oscillator. The design of the high-level stage is based on an attempt to reduce the scale of the installation. Therefore, an acceleration structure of the electromagnetic cavity type charged with ferrites was adopted. (J.S.R.)

22558

MAGNETIC TRIGGERING OF THE SATURNE INTEGRATOR. M. Dagai, J. Lecomte, and G. Rastoix (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 526-9(1959) June. (In French)

The apparatus utilized in the Saturne synchrotron to trigger the high frequency integrator is described. The electron paramagnetic resonance method is used to measure the magnetic field. An operational diagram of the apparatus is given. The UHF generator, UHF circuit, resonating cavity, and the electronic arrangement are described. (J.S.R.)

22559

ANALOG COMPUTER FOR THE CONTROL OF THE SATURNE MASTER-OSCILLATOR. A. Gabet (Centre d'Études Nucléaires, Saclay, France) and J. Martin. Onde élec. 39, 530-6(1959) June. (In French)

The analog computer is designed to furnish the master oscillator a variable current under the control of the magnetic field. The computer circuit contains an electronic interrupter, integrator, oscillator, function generator, and a power amplifier. These and the measurement loop for magnetic field determinations are described. (J.S.R.)

22560

THE SATURNE MASTER OSCILLATOR. B. Chiron (Societe Lignes Télégraphiques et Téléphoniques, Paris) and R. Schoen (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 537-42(1959) June. (In French)

The frequency generator or master oscillator is controlled by the magnetic field only and time has no influence on the frequency produced. The most important part of the study of the master oscillator was the study of the ferrite used to form the core of variable inductance. The required characteristics for the ferrite are discussed, and the test results led to the adoption of "Fernilite 1101 special" as the ferrite to be used in the Saturne master oscillator. The factors which affect the characteristic $f = \phi(I)$, where f is the frequency delivered by the master oscillator to the ferrite and I is the control current governed by the function generator, are determined. The thermostat which stabilized the ferrite temperature is described. (J.S.R.)

22561

THE SATURNE ACCELERATION CAVITY. J. Lecomte, R. J. Le Gardeur, and J. Taillet (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 543-55(1959) June. (In French)

The acceleration structure chosen for the Saturne is the inductive cavity with the variation of the tuning frequency obtained by saturation of the ferrite core of the cavity by means of a current which increases along the cycle and by decrease of the capacity of an auxiliary condenser at the edge of the acceleration gap. A simplified diagram of the cavity auxiliaries is given, and the operation of the arrangement is described. The properties of the ferrites used, such as the permeability and coefficient of overvoltage, are reviewed. The acceleration cavity itself is described. The acceleration cavity chosen and the tuning method selected reduces the power dissipated in the tubes of the high-frequency amplifier. The variable condenser used and the coupling systems are also described. (J.S.R.)

22562

FERRITE MAGNETIC CIRCUIT FOR THE SYNCHROTRON CAVITY. G. Delyon, G. Gomez, Y. Lescroel, and A. Pierrot (Société Lignes Télégraphiques et Téléphoniques, Conflans-Sainte-Honorine, France). Onde élec. 39, 556-60(1959) June. (In French)

The ferrite core of the acceleration cavity is composed of about thirty frames or skeletons. The frames are made of twenty bricks forming a rectangle with a window in the center. The ferrite bricks are held together with ethyoxyline (Araldite). The fabrication of the frames is, in principle, identical to the normal fabrication of ferrite cores. The techniques used are briefly reviewed. (J.S.R.)

22563

HIGH-FREQUENCY AMPLIFIER OF THE ACCELERATION SYSTEM OF SATURNE. V. Glaude, B. Levy, and G. Leproux (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 560-3(1959) June. (In French)

The high-frequency amplifier designed for the Saturne proton synchrotron is capable of furnishing 6 kw power (at peak voltage of 3000 v). The functional diagram of the amplifier is given and divided into three parts: the coupling components, preamplifiers, and

power amplifiers. Each part is described in detail. (J.S.R.)

22564

TRANSISTORIZED 400 AMPERE DIRECT CURRENT AMPLIFIER. V. Goursky and P. Gutmann (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 564-7(1959) June.

The direct current amplifier is in a control loop to tune the synchrotron cavity to the instantaneous acceleration frequency. The power and command stages of the amplifier are determined, and a schematic diagram is given. The auxiliary installations used with the amplifier are briefly discussed. (J.S.R.)

22565

SATURNE CONTROL AND MONITORING SYSTEM. P. Debraine and R. Segalas (Centre d'Études Nucléaires, Saclay, France) and R. Locque. Onde élec. 39, 568-74(1959) June. (In French)

The general principles governing the control and monitoring of the Saturne are discussed. The principal control room, the auxiliary control room, and the radiation control room are described. The characteristics of the power supply system, pumping equipment, cooling, electromagnets, high-frequency system, and general circuits are briefly considered. (J.S.R.)

22566

SATURNE TIMING SYSTEM. R. Charbonnier (Rochar Electronique, France) and P. Debraine, G. Rastoix, and R. Segalas (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 575-81(1959) June. (In French)

The timing circuits of the Saturne are divided into three categories: the controls relative to the magnet power supply, the triggering mechanisms, and the controls governing the cycle periods. The magnet timing and the triggering circuits are briefly discussed, but the controls governing the cycle periods are described in some detail. The principle of operation of these controls are considered. (J.S.R.)

22567

THE SATURNE BEAM DETECTION. J. C. Marchais and M. Y. Romain (Compagnie Générale de T.S.F., France) and G. Rommel (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 582-7(1959) June. (In French)

The beam detection system of Saturne is based on the electrostatic effect of a charged particle beam on an insulated metal plate. The electrode system used in beam detection is described. The electronic conditions for the measurement of the number of protons and the design chosen are discussed. (J.S.R.)

22568

SHIELDING OF THE SATURNE SYNCHROTRON. Y. Duvaux, F. Dubois, P. Stickel, and F. Penet (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 588-91(1959) June. (In French)

The Saturne shielding is designed to protect the personnel and the apparatus from the radiation emitted by the accelerator. The shielding consists of a fixed wall surrounding approximately 150° of the accelerator, a mobile wall surrounding the 210° not protected by the fixed wall, re-enforcement of the fixed wall, and a 1.80 m concrete roof over the accelerator. The fixed and mobile walls have been constructed, and the re-enforcement and roofing are being constructed. The construction of the mobile wall is described. The shielding of the instruments is discussed. (J.S.R.)

22569

RADIATION CONTROL NEAR THE SATURNE ACCELERATOR. P. Candes, H. Joffre, and A. Stirling (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 591-5(1959) June. (In French)

Personnel protection against radiation from Saturne is assured by signal lights announcing the stage of operation and by radiation detectors. The signal lights used and the detection of low-energy scattered radiation and high-energy radiation are discussed. (J.S.R.)

22570

SUPPORTING STRUCTURE OF THE SATURNE SYNCHROTRON AT SACLAY. R. Vinard and M. De Lamotte. Onde élec. 39, 596-602(1959) June. (In French)

The problems caused by the extreme tolerances for deformation in the support of a synchrotron are discussed, and the admissible deformations for the Saclay synchrotron are tabulated. The possible solutions for these problems are considered. The supporting structure adopted is composed of a rigid ring in which the pseudo-circular axis corresponds exactly to that of the magnet and which rests on 24 piles, through the use of identical level jackscrews. The foundation wells are described in some detail. (J.S.R.)

22571

EXPERIMENTATION AT SATURNE. A. Berthelot (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 603-4(1959) June. (In French)

A brief survey is given of the experimental facilities available at Saturne. The apparatus are described in detail in separate articles. (J.S.R.)

22572

ELECTROMAGNETS USED FOR SATURNE. B. Tsai and H. Desportes (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 605-7(1959) June. (In French)

The quadrupole lenses and electromagnets used to isolate, direct, and concentrate a homogeneous particle beam are discussed. Their construction characteristics and experimental utilization are described. The secondary beams obtainable are also considered. (J.S.R.)

22573

DIRECT CURRENT POWER SUPPLY AND COOLANT SYSTEM FOR EXPERIMENTAL MAGNETS AND COILS OF LARGE PHYSICS APPARATUS. P. Stickel and R. Gouiran (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 608-11(1959) June. (In French)

The direct power supply and the coolant system for the experimental magnets and coils must have great mobility and flexibility. The rotating converters and ignitrons used to supply the magnets and coils are described. The coolant system is a closed system pumping approximately 110 m^3/hr. The control of the power supply and coolant water is discussed. (J.S.R.)

22574

LIQUID HYDROGEN TARGETS. P. Prugne, M. Marquet, and M. Bougon (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 612-14(1959) June. (In French)

There are two types of liquid hydrogen targets; targets at atmospheric pressure and vacuum targets with low hydrogen consumption. The design and construction of each type are described and illustrated. (J.S.R.)

22575

THREE-LITER HYDROGEN BUBBLE CHAMBER.

J. Meyer (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 615-17(1959) June. (In French)

The 3-liter hydrogen bubble chamber constructed at Saclay is illustrated. The construction of the chamber itself, the coolant system and the maintenance of the temperature, and the chamber operation and performance are described. (J.S.R.)

22576

SIXTEEN-LITER PROPANE BUBBLE CHAMBER. A. Rogozinski (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 617-20(1959) June. (In French)

The propane bubble chamber is machined in a block of duralumin and is provided with a constant magnetic field of about 13 k gauss. The complete apparatus consists of the chamber itself with its accessory components and some auxiliary installations. The auxiliary installations include a compressor, stabilized thermostat, electronic control circuits, and support. The accessory and auxiliary installations are briefly described. The operational safety of the chamber is discussed. (J.S.R.)

22577

HEAVY LIQUID BUBBLE CHAMBER OF THE PHYSICS LABORATORY OF THE ÉCOLE POLYTECHNIQUE. A. Lagarrigue (Laboratoire de Physique de l'Ecole Polytechnique, Paris). Onde élec. 39, 621-22(1959) June. (In French)

To detect photons and neutral π mesons in a bubble chamber, the chamber must contain elements with a sufficiently high atomic mass to assure pair production by the interaction of the photons with the electric field of the heavy nucleus. A bubble chamber containing a mixture of propane and methyl iodide in the ratio of 1:1 by volume was constructed for this purpose. The chamber itself is of stainless steel which is highly resistant to corrosion by methyl iodide. Copper joints were first used, but these are being replaced by the new elastomer "Viton." (J.S.R.)

22578

PROGRAM OF THE SERVICE DE PHYSIQUE CORPUSCULAIRE A HAUTE ÉNERGIE FOR THE CONSTRUCTION OF HYDROGEN BUBBLE CHAMBERS. P. Prugne (Centre d'Études Nucléaires, Saclay, France). Onde élec. 39, 623-6(1959) June. (In French)

Two hydrogen bubble chambers, one of 21 liters and the other of 70 liters, are being constructed at Saclay. The smaller chamber, from the cryogenic and operation viewpoints, will serve as a pilot installation for the larger chamber. Both are to be constructed from blocks of duralumin and will be machined in a spherical shape. The general outline of the circuits are illustrated. (J.S.R.)

22579

EQUIPMENT OF THE ELECTRONICS GROUP OF THE SERVICE DE PHYSIQUE CORPUSCULAIRE À HAUTE ÉNERGIE OF THE CENTRE D'ÉTUDES NUCLÉAIRES, SACLAY. J.-C. Brisson, J.-F. Detoeuf, P. Falk-Vairant, B. Thevenet, G. Valladas, and L. Van Rossum (Centre d'Études Nucleaires, Saclay, France). Onde élec. 39, 626-30(1959) June. (In French)

The electronic equipment used at Saturne in the detection and measurement of high-energy particles is described. The different types of necessary apparatus, such as detectors, coincidence and analysis circuits, counting and recording circuits, auxiliary apparatus, and the measurement and control apparatus, are discussed. The use of these apparatus are illustrated by a description of the measurement of the proton contamination of a high-energy beam of π^+ and the measurement of the total cross section for $\pi^+ + p$. (J.S.R.)

22580

WILSON CLOUD CHAMBER EXPERIMENT MADE BY THE PHYSICS LABORATORY OF THE ÉCOLE POLYTECHNIQUE AT THE SATURNE ACCELERATOR OF THE C.E.N. AT SACLAY. A. Astier. Onde élec. 39, 630-2(1959) June. (In French)

Cloud chamber studies will be made of the decay modes of the heavy meson K_2^0. A copper target is to be placed in the vacuum chamber of the synchrotron, and the proton beam interacting with the target will create instable heavy particles, among them K_2^0. The neutral beam from the target, consisting of the mesons and neutrons, will then be directed to the cloud chamber. The advantages and disadvantages of the cloud chamber for such experiments are discussed, and the characteristics of the chamber to be used are described. (J.S.R.)

22581

THE SATURNE BUDGET. R. Maillet and R. Florent (Centre d'Études Nucléaires, Saclay, France). Onde élec 39, 633-4(1959) June. (In French)

The cost of the Saturne accelerator is briefly discussed. The investments made by the conclusion of 1958 are tabulated. The expenses to be incurred in 1959 are briefly considered. (J.S.R.)

22582

METHODS OF FOCUSING ELECTRON BEAMS IN MODERN ULTRA HIGH-FREQUENCY (MICROWAVE) DEVICES. Z. S. Chernov. Radiotekh. i Elektron. 3, 1227-42(1958).

The existing systems of focusing electron beams can be classified as homogeneous and periodic. In the first class of the devices, the focusing fields which compensate the Coulomb forces are constant along the beam, whereas the second class ensures the required configuration of the beam by passing it through a periodic system of magnetic or electrostatic lenses or mirrors. The focusing systems can also be divided into magnetic and electrostatic or combined devices. A classification diagram is included and described. The method of employing a longitudinal magnetic field is the simplest and consists of employing a strong field in order to equalize the electron trajectories. The Brillouin beam is a development of this system; in this case, an electron beam having a circular cross-section is rotated around the axis whose direction is parallel to the magnetic field. This method permits the focusing of electrons by employing comparatively low fields but there are practical difficulties in constructing appropriate focusing systems. The centrifugal, electrostatic focusing system is based on the use of a helical electron gun and a pair of helical focusing electrodes. It is concluded that the sharpness of the Brillouin beam and that of the centrifugal, electrostatic focusing are almost the same, whereas the focusing by longitudinally magnetic field is slightly sharper. The rotating beams in a periodic, electrostatic system have the highest focusing sharpness. (TCO)

22583

LINEYNYYE USKORITELI; SBORNIK STATEY. (Linear Accelerators; Collection of Articles). G. A. Tyagunov and R. A. Negrimovskaya, eds. Moscow, Inzhenerno-Fizicheskiy Institut, 1959. 94p.

The theory and operation of linear accelerators

developed by MIFI are discussed. Methods of measuring variable phase velocity in a waveguide of a linear electron accelerator are described and ways of determining the diameter of a waveguide are discussed. A method of improving the energy spectrum at the output of an accelerator is also discussed. (TCO)

22584

STANFORD LINEAR ELECTRON ACCELERATOR. HEARINGS BEFORE THE SUBCOMMITTEE ON RESEARCH AND DEVELOPMENT AND THE SUBCOMMITTEE ON LEGISLATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON STANFORD LINEAR ELECTRON ACCELERATOR, JULY 14 AND 15, 1959. Washington, D. C., Joint Committee on Atomic Energy, 1959. 653p. (GPO)

A description is given of a high-energy linear electron accelerator. Construction of the proposed $105 million machine is to begin in 1960 and be completed by 1965. The machine will be approximately 2 miles in length, powered by 240 klystron amplifiers operating at 6 Mw, and in initial stages will achieve an energy range of 10 to 15 Bev with an average current of 30 μa. The accelerating tube is to be housed in a horizontal tunnel approximately 10 ft wide and deep enough in the ground to provide necessary shielding. A parallel tunnel approximately 24 ft wide will contain the radio-frequency equipment and wiring. The tunnels are approximately 35 ft apart permitting service on the equipment during accelerator operation. Schematic drawings of the various accelerator components and facilities associated with the accelerator are given. Proposed annual operating costs for the accelerator and facilities are estimated. (C.J.G.)

22585

ION SOURCE. W. M. Brobeck (to U. S. Atomic Energy Commission). U. S. Patent 2,882,410. Apr. 14, 1959.

This patent deals with calutrons and more particularly to an arrangement therein whereby charged bottles in a calutron source unit may be replaced without admitting atmospheric air to the calutron vacuum chamber. As described, an ion unit is disposed within a vacuum tank and has a reservoir open toward a wall of the tank. A spike projects from the source into the reservoir. When a charge bottle is placed in the reservoir, the spike breaks a frangible seal on the bottle. After the contents of the bottle are expended the bottle may be withdrawn and replaced with another charge bottle by a vacuum lock arrangement in conjunction with an arm for manipulating the bottle.

22586

ION PRODUCING MECHANISM (CHARGE CUPS). W. W. Brobeck (to U. S. Atomic Energy Commission). U. S. Patent 2,883,541. Apr. 21, 1959.

The problems of confining a charge material in a calutron and uniformly distributing heat to the charge is described. The charge is held in a cup of thermally conductive material removably disposed within the charge chamber of the ion source block. A central thermally conducting stem is incorporated within the cup for conducting heat to the central portion of the charge contained within the cup.

22587

ELECTRONIC PHASE CONTROL CIRCUIT. J. D. Salisbury, W. W. Klein, and C. F. Hansen (to U. S. Atomic Energy Commission). U. S. Patent 2,883,536. Apr. 21, 1959.

An electronic circuit is described for controlling the phase of radio frequency energy applied to a multicavity linear accelerator. In one application of the circuit two cavities are excited from a single radio frequency source, with one cavity directly coupled to the source and the other cavity coupled through a delay line of special construction. A phase detector provides a bipolar d-c output signal proportional to the difference in phase between the voltage in the two cavities. This d-c signal controls a bias supply which provides a d-c output for varying the capacitance of voltage sensitive capacitors in the delay line. The over-all operation of the circuit is completely electronic, overcoming the time response limitations of the electromechanical control systems, and the relative phase relationship of the radio frequency voltages in the two cavities is continuously controlled to effect particle acceleration.

22588

ION PRODUCING MECHANISM. F. F. Oppenheimer (to U. S. Atomic Energy Commission). U. S. Patent 2,882,411. Apr. 14, 1959.

This patent pertains to calutrons and more particularly to means for introducing gas at selected points in the arc chamber of a calutron source to remedy unsteadiness in the arc. The disclosed ion source has a baffle at the gas entrance in the arc chamber for directing part of the gas flow toward the anode end of the chamber. The resulting arc is much steadier, resulting in an ion beam of increased current.

22589

HIGH VOLTAGE GENERATOR. G. V. Zito (to U. S. Atomic Energy Commission). U. S. Patent 2,883,551. Apr. 21, 1959.

This patent relates to high voltage supply circuits adapted for providing operating voltages for Geiger-Mueller counter tubes, and is especially directed to an arrangement for maintaining uniform voltage under changing conditions of operation. In the usual power supply arrangement for counter tubes the counter voltage is taken from across the power supply output capacitor. If the count rate exceeds the current delivering capacity of the capacitor, the capacitor voltage will drop, decreasing the counter voltage. The present invention provides a multivibrator which has its output voltage controlled by a signal proportional to the counting rate. As the counting rate increases beyond the current delivering capacity of the capacitor, the rectified voltage output from the multivibrator is increased to maintain uniform counter voltage.

22590

PULSED ION SOURCE. W. D. Kilpatrick (to U. S. Atomic Energy Commission). U. S. Patent 2,883,580. Apr. 21, 1959.

A source is presented for producing high intensity pulses of ions with precise time control of pulse initiation. The approach taken is to have one of the electrodes in the source occluded with the gas to be ionized. A trigger electrode is disposed adjacent to the gas filled electrode and is pulsed with a voltage to release the gas. The other structure of the source includes an apertured anode disposed between two cathodes, the gas filled electrode and another electrode. At the same time the gas is released a low voltage pulse is applied between the anode and cathodes to establish an ionizing arc discharge. An electrode adjacent to the arc withdraws the ions.

PHYSICS AND MATHEMATICS

General

22591 AD-207049
Stanford Univ., Calif.
THE TRANSIENT RESPONSE OF GAS TURBINE PLANT HEAT EXCHANGERS—REGENERATORS, INTERCOOLERS, PRECOOLERS, AND DUCTING. Technical Report No. 38. A. L. London, F. R. Biancardi, and J. W. Mitchell. Oct. 15, 1958. 50p. Contract Nonr 225(23).

Transient response of heat exchangers are investigated. Analog solutions are used to supplement some limiting analytical solutions to provide fairly complete coverage for the heat exchangers encountered in gas turbine plants. Because a gas-flow exists on at least one side of the heat transfer surface, these exchangers are characterized by a large wall capacitance effect. Where greater generality is possible the extension to other heat exchangers is indicated. Included is a consideration of the transient response of insulated ducts and pipes, applicable to either the flow of liquids or gases. (auth)

22592 AD-215600
Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE DETERMINATION OF DISTRIBUTION COEFFICIENTS IN ZONE-REFINED SILICON USING RADIOACTIVE ISOTOPES; A FEASIBILITY STUDY (thesis). Robert L. Fish. Mar. 1959. 85p.

The distribution coefficients of impurities in silicon were determined in the past mainly from single crystals prepared by the Czochralski pulling method. A brief review of this method, and the procedures which were used to determine these coefficients are presented. Principles of the use of zone melting in determining coefficients distribution are discussed in detail. A graphic solution is illustrated in connection with the single-pass distribution method of zone melting. Gold is the principal impurity studied, although the same principles could be used to study other impurities. Use of radioactive isotopes as means for determining small impurity concentrations are examined. In one method, radioactive gold atoms are added to the silicon ingot. After a single molten zone is passed through the ingot, it is sectioned, and the activity of each section is counted. A 3″ × 3″ NaI(Tl) well-type crystal is considered for counting the gold radiations (0.411 Mev gammas). In another method, stable gold atoms are added to the ingot before the zoning operation. Sections from this ingot are irradiated in a thermal neutron flux, and counted as described before. The sensitivity of both methods is 10^{11} atoms of gold per section. The principal disadvantage of the first method is in connection with the radiation hazards associated with sectioning the radioactive ingot. The total activity produced by the gold gammas is only about two (2) millicuries. However, 0.02 millicuries of activity may be removed in one cutting operation. Therefore, special provisions are required to contain the radioactive dust generated by this cutting operation. The radiation hazards associated with the second method are relatively minor, because the doping and cutting operations are performed on an inactive ingot. The principal disadvantage of the second method is in connection with the interference produced by the other impurities in the silicon. The amount of interference produced by 29 other impurity elements found in silicon is analyzed in detail. Procedures for measuring the gold radiation in the presence of interference are discussed and suggestions are made for future experimental work to check the predicted results. (auth)

22593 AD-215961
Westinghouse Electric Corp. Research Labs., Pittsburgh.
THERMOELECTRICITY. Progress Report No. 3. Apr. 14, 1958. 34p. Contract NOBS-72361.

Previous experimental work on mixed valence materials is reviewed. Current work is centered around the investigation of the homologous compounds $Li_xMn_{1-x}O$, $Li_xCo_{1-x}O$, $Li_xNi_{1-x}O$, and $Li_xCu_{1-x}O$. Results of electric conductivity measurements on the compounds are presented graphically. Models for conduction processes and charge carrier mobility are presented. The techniques and results of experiments to determine trapping energies are discussed in which the Se analogue of $Li_xMn_{1-x}O$ was studied. These data indicated that the mobility was unaffected. Observed changes from antiferromagnetism to double exchange ferromagnetism to normal ferromagnetism as the concentration of Li increased was attributed to the increasing number of conducting electrons. Theory of thermoelectric power and electric conductivity is developed and formulas are derived for expression of thermoelectric power. Figure of merit in mixed valence materials is discussed and criteria for compounds having desirable properties for such classification are listed. In thermal design, a study of power production for fixed ducts was concluded, and is now being extended to forced convective air flows. Also construction of a high-speed conductivity apparatus is reported. In design for actual thermoelectric generators, a number of previous design formulas were rewritten. (J.R.D.)

22594 AD-215962
Westinghouse Electric Corp. Research Labs., Pittsburgh.
THERMOELECTRICITY. Progress Report No. 4. May 12, 1958. 36p. Contract NOBS-72361.

Preparation and study of mixed valence materials such as compositions of $MnTe_{1-x}As_x$ and compounds such as TiO_2, ZrO_2, and $CuFeS_2$ are reported. Also data on compositions of $Li_xMn_{1-x}Se$ are presented along with data on properties of InAs, InSb, Pb_2TeSe, and several new semiconducting compounds including $InBiSe_3$ and In_2Te_3. Transition metal borides, carbides, nitrides, and silicides were surveyed; about 30 compounds were prepared, and data indicate that $CrSi_2$ and $MnSi_2$ are the only reasonable prospects for use in thermoelectric power development. Detailed description of mixed valence preparation techniques is included along with a review of progress in solid state chemical reactions. (For preceding period see AD-215961.) (J.R.D.)

22595 AD-215963
Westinghouse Electric Corp. Research Labs., Pittsburgh.
THERMOELECTRICITY. Progress Report No. 6. July 30, 1958. Includes paper: SOLID-LIQUID PHASE EQUILIBRIA IN THE PSEUDO-BINARY SYSTEM Bi_2Te_3–Bi_2Se_3. Scientific Paper 431FD271-P1. J. P. McHugh and W. A. Tiller. June 17, 1958. 59p. Contract NOBS-72361.

Theoretical exploration of Ce–S, Th–S, and In $As_{1-x}P_x$ systems is reported. Experimental findings are reported including confirmation of hypotheses rele-

vant to electron transport mechanism, and recording of figure of merit data on InAs-Se, InAs-S, and InSb systems. Reduced thermal conductivity crystals with good charge carrier mobility were prepared. Investigation of several mixed valence materials is reported. Measurements indicate that $MnTe_{1-x}As_x$ decomposes at 300 to 500°C and a more stable compound is being sought in $MnTe_{1-x}Sb_x$. Data on Zr compounds such as $La_xBa_{1-x}ZrO_3$ are given. Preparation of Ce_2S_3-Ce_3S_4 systems are reported. Also data on semiconductors and semimetals such as InAs, InSb, $Bi_{2-x}Sb_xTe_{3-y}Se_y$, $Mn_2Si_xSn_{1-x}$, and Zn–Sb are given along with data on the thermoelectric power of $CeSi_{2+n}$. The use of semiconductors in thermoelectric devices is considered with particular emphasis on Peltier effect refrigerators and Seeback effect generators. It is pointed out that the value of a material as thermoelectric element is related to its figure of merit. Theory and maximization parameters of the figure of merit are studied. Factors which enter into consideration of semiconductor electron transport properties are discussed. These comprise information about degeneracy of the conducting electrons, extrinsic and intrinsic range, and band structure and effective mass. Review of developments in semiconductor electric conductivity, thermoelectric power expressions, thermal conductivity, and figure of merit optimization is given. Also data on liquidus and solidus surfaces for the system Bi_2Te_3-Bi_2Se_3 are presented along with partition coefficients for Te and Se. (J.R.D.)

22596 AD-215964

Westinghouse Electric Corp. Research Labs., Pittsburgh.

THERMOELECTRICITY. Progress Report No. 8. Oct. 1, 1958. Includes Papers: ALLOY CRYSTAL GROWTH. Scientific Paper 431FD272-P1. W. A. Tiller. Sept. 18, 1958; ARC FURNACE PREPARATION OF REFRACTORY COMPOUNDS. Scientific Paper 431FD270-P3. H. A. Johansen. June 11, 1958; STUDIES OF POLARON MOTION. II. THE "SMALL" POLARON. Research Memo 403FD211–M2. T. Holstein. Sept. 26, 1958. 95p. Contract NOBS-72361.

The preparation and properties of various thermoelectric materials are considered. Material parameters are summarized. Alloy crystal growth, arc furnace preparation of refractory compounds, and polaron studies are reported. (W.D.M.)

22597 AD-216016

Westinghouse Electric Corp. Research Labs., Pittsburgh.

THERMOELECTRICITY. Progress Report No. 5. June 23, 1958. Includes papers: STUDIES OF POLARON MOTION. I. THE MOLECULAR-CRYSTAL MODEL. Research Memo 431FD211-M1. T. Holstein. May 28, 1958; MEASUREMENT OF THERMOELECTRIC MATERIALS UNDER SIMULATED GENERATOR CONDITIONS. Research Report 431FD281-R1-X. S. J. Angello and C. S. Duncan. June 11, 1958; ZINC IN METAL OXIDES. Research Report 431FD275-R1. R. J. Nadalin. June 4, 1958; THE USE OF CONTROLLED SOLIDIFICATION IN EQUILIBRIUM DIAGRAM STUDIES. Scientific Paper 431FD112-P1. W. A. Tiller. Apr. 22, 1958. 106p. Contract NOBS-72361.

Basic research for information to be used in thermoelectric elements is reviewed. Initial efforts are restricted to simplified models of mixed valence crystals. Reports on crystal growth and thermoelectric element diffusion are given. A description of a molecular crystal model which is the basis for a number of polaron problem studies is presented. Also, an apparatus for measuring thermoelectric materials parameters under conditions of large thermal gradients between 25 and 450°C is described. Data for ZnSb are included. Development of analytical methods for samples of $Li_x(Ni_yZn_{(1-y)})_{1-x}O$ are reported. Theoretical use of controlled solidification in phase diagram studies for determination of liquids, and surface plus tie-lines for a polycomponent alloy is described. (For preceding period see AD-215962). (J.R.D.)

22598 AD-216680

Westinghouse Electric Corp. Research Labs., Pittsburgh.

THERMOELECTRICITY. Progress Report No. 9. Oct. 17, 1958. Includes papers: OPTIMIZATION OF THE AVAILABLE POWER AND POWER DENSITY OF A FUEL-FIRED THERMOELECTRIC GENERATOR. Research Report 431FD282-R4-X. B. W. Swanson and E. V. Somers. Oct. 19, 1958; DESIGN PROCEDURE FOR THERMOELECTRIC POWER GENERATORS. Research Report 414FD307-R1. Stephen Angello. Aug. 22, 1958. 43p. Contract NOBS-72361.

An analysis of the thermoelectric power output of a fuel-fired thermoelectric generator is presented. The conditions under which the available power, and power density may be optimized are determined. Detailed optimization criteria are developed mathematically. An outline of the procedure for design of practical thermoelectric generators is also given. The procedure is based on several propositions which are stated and developed. (J.R.D.)

22599 AD-217109

New York Univ., New York.

RESEARCH ON SOLID STATE RADIATION-INDUCED PHENOMENA. Quarterly Report No. 4 for January, February, March [1959]. Hartmut Kallmann. May 1959. 42p. Contract DA-36-039-sc-75043.

The theory of time constant measurements in liquid and rigid solutions is considered. An explanation of the time constant curves obtained by various authors is derived from the theory of Kallmann and Brucker, in which there are essentially two time constants. These are the decay time of the solute measured in dilute solutions under light excitation, and the decay time of the solvent. Remarks are presented on papers given at the Faraday Society discussion on energy transfer. The storage of energy and its release in ZnCdS phosphors is investigated by the method of rise curves. The dependence of rise curves on Cd concentration in Mn, Au, Ag, and Cu activated phosphors is presented. The impedance and luminescence of 3 ZnCdS phosphors under various conditions of excitation at room temperature and liquid nitrogen temperature was measured. A vacuum system is used to keep the sample moisture free at low temperatures. (For preceding period see NP-7322.) (W.D.M.)

22600 AECU-4314

Illinois, Univ., Urbana. Digital Computer Lab.

CIRCUIT DESIGN FOR THE NEW ILLINOIS COMPUTER. Report No. 90. W. J. Poppelbaum and N. E. Wisaman. Aug. 20, 1959. 110p. Contract AT(11-1)-415. $16.80(ph), $5.70(mf) OTS.

The circuit design for the new Illinois computer including the general design philosophy, hardware parameters, and circuit performance, reliability and tol-

erance considerations, description of new computer circuits, computer use for circuit design, and transistor, diode, resistor, and power supply specifications is reported. (J.E.D.)

22601 AECU-4321
[Knolls Atomic Power Lab., Schenectady, N. Y.]
704 PERTURBATION CALCULATION (PSP). [D. E. Turcotte 1959]. 8p. $1.80(ph), $1.80(mf) OTS.

A code designed to compute from given cross-section changes partial reactivity summations is described. Required input information is given as well as the card format and form of the output. (J.R.D.)

22602 AECU-4341
Illinois. Univ., Urbana. Electrical Engineering Research Lab.
FREQUENCY MULTIPLICATION CIRCUITS. Technical Report No. 3. Andrew William Swago. Sept. 11, 1959. 264p. Contract AT(11-1)-392. $37.80(ph), $11.10(mf) OTS.

Positive nonlinear resistive and nonlinear reactive elements in lumped-element doubler circuits are considered whose performances approach the theoretical capabilities. Suggestions for microwave equivalents for these circuits are offered. Points chosen as guiding principles for doubler circuit selection are discussed. 115 references. (W.D.M.)

22603 AECU-4342
RAND Corp., Santa Monica, Calif.
RELATIVISTIC SELF-CONSISTENT CALCULATION FOR THE IRON ATOM. Stanley Cohen. June 30, 1959. 24p. Contract AT(11-1)-135, Project Agreement No. 5. (RM-2406-AEC). $4.80(ph), $2.70(mf) OTS.

Also issued as UCRL-8734, April 21, 1959.

The relativistic self-consistent solution for the iron atom is presented. A comparison is made between the energy eigenvalues for each of the subshells with corresponding experimentally determined energy-term values. (auth)

22604 AECU-4343
Massachusetts Inst. of Tech., Cambridge. Lab. of Chemistry and Solid-State Physics.
ANNUAL RESEARCH REPORT. July 15, 1959. 69p. $10.80(ph), $3.90(mf) OTS. Supported by AEC; ONR; USAF; OOR; DA; National Science Foundation; and National Institutes of Health.

Progress is reported on the following: solid-state and molecular theory, structure of solids by x-ray and neutron diffraction, low-temperature and thermal properties of matter, nuclear magnetic resonance, molecular spectroscopy, interatomic and intermolecular forces, chemical and physical chemistry of macromolecules, physical metallurgy, and mechanical properties of solids. (W.L.H.)

22605 AECU-4348
Stevens Inst. of Tech., Hoboken, N. J.
MEGATRON ACCELERATOR PROGRESS REPORT—INVESTIGATION OF PLASMA ACCELERATION. Quarterly Progress Report No. 2 [for] October 1, 1958–December 31, 1958. K. C. Rogers, G. Brucker, L. Ferrari, I. Mansfield, and D. Caulfield. 19p. Sponsored by U. S. Atomic Energy Commission and U. S. Army Signal Supply Agency under Contract DA 36-039SC-78097 (AD-214249). $3.30(ph), $2.40(mf) OTS.

The construction of the Megatron, a high-flux density, high-current betatron (150 Mev 1000 A), was continued. Possible methods of shaping pulsed magnetic fields are described and measuring techniques are indicated for application to an air core betatron. A sand loaded epoxy vacuum chamber is described and its use in a high-voltage high-current switch is suggested. (W.D.M.)

22606 AECU-4353
RAND Corp., Santa Monica, Calif.
GRAPHS OF X-RAY ABSORPTION COEFFICIENTS FOR FOURTEEN SUBSTANCES. Forrest R. Gilmore. Apr. 10, 1959. 21p. Contract AT(11-1)-135, Project Agreement No. 5. $4.80(ph), $2.70(mf) OTS. (RM-2367-AEC).

A collection of experimental and theoretical values for the x-ray-absorption coefficients of fourteen substances in the energy range from 0.1 to 100 kilovolts is given. These substances are beryllium, carbon, nitrogen, oxygen, aluminum, iron, copper, silver, tin, gold, lead, uranium, air, and sodium iodide. (auth)

22607 AECU-4356
Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
THE LATERAL DISTRIBUTION OF PENETRATING PARTICLES IN COSMIC RAY EXTENSIVE AIR SHOWERS. Technical Report No. 70. James Arthur Earl. Aug. 31, 1959. 90p. Sponsored by National Science Foundation; AEC; and ONR under Contract Nonr-1841-(16). $15.30(ph), $5.40(mf) OTS.

The penetrating component of extensive air showers detected by the MIT air shower experiment at Harvard, Massachusetts, was observed with the aid of a large hodoscope shielded by 985 g/cm^2 of lead. The number of electrons, core location, and arrival direction of each shower were given by the air shower experiment. Mu-mesons associated with a shower could be identified by requiring the projected zenith angle as measured by the hodoscope to agree with the known arrival direction of the shower. An auxilliary detector consisting of a single heavily shielded tray of counters was operated 920 m from the center of the array. In showers with zenith angles less than 25° the density of mu-mesons is proportional to $r^{-1.0 \pm 0.2}$ for r between 20 and 150 m. (r is the distance from the shower core to the meson detector.) For r between 200 and 900 m the density is proportional to $r^{-2.2 \pm 0.1}$. The shape of the lateral distribution changes as the zenith angle of the showers is increased. The nature of this change is such that the mesons is inclined showers are more spread out than those in vertical showers. The effect of the magnetic field of the earth on the lateral distribution is small. The meson density near the core is proportional to $Ne^{0.79 \pm 0.05}$ where Ne is the number of electrons in the shower. For showers with a constant observed number of electrons, the meson density near the core does not change with zenith angle. This fact implies that, in a shower of given primary energy, the density near the core decreases exponentially with depth with an absorption length of (253 ± 40) g/cm^2. The fraction of the mu-mesons with ranges greater than 540 g/cm^2 of lead which are absorbed in an additional 360 g/cm^2 of lead is (9.9 ± 1.5) %. This fraction is independent of distance to the core for r between 40 and 300 m. (auth)

22608 AECU-4369
Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
EXTENSIVE AIR SHOWERS AT SEA LEVEL. Technical Report No. 71. Frank Scherb. Aug. 31, 1959. 87p. Sponsored by National Science Foundation; AEC; and

ONR under Contract Nonr-1841-(16). $13.80(ph), $4.80 (mf) OTS.

The purpose of the experiment was the determination of the total number of particles and zenith-angle distribution at sea level of extensive air showers having sizes ranging from 5×10^5 to 3×10^6 particles. The apparatus consisted of an array of 15 large scintillation detectors, which were distributed over an area of 40 acres, and the associated electronics and recording equipment. The size, orientation, and core location of each shower could be determined accurately with the experimental set-up. (W.D.M.)

22609 AECU-4376
Illinois Univ., Urbana.
THE NOBLE METAL CRYSTAL POTENTIAL AS OBTAINED FROM SHOCK WAVE DATA. Technical Report No. 19. G. E. Duvall and J. S. Koehler. Sept. 1959. 15p. Contract AT(11-1)-182. $3.30(ph), $2.40(mf) OTS.

A description is given of the use of shock wave data to obtain information about the atomic interactions in a compressed crystal. The results are compared with other expressions for the interaction potentials in these elements. (W.L.H.)

22610 AERE-R-2929
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A MONTE CARLO STUDY OF THE RESONANCE ABSORPTION AND ITS TEMPERATURE VARIATION IN A SQUARE URANIUM–GRAPHITE LATTICE. K. W. Morton. July 1959. 34p. $0.70(BIS).

A program written for the IBM 704 to calculate neutron cross sections for a heavy even-even nucleus in the resonance region is described, and a program for calculating by Monte Carlo the resonance absorption of such an isotope in a particular reactor lattice is given. Results are given for the Calder Hall lattice at three different temperatures and for a scaling up and a scaling down of this lattice for two of these temperatures. The results are linked with analytical expressions in the unresolved resonance region and compared with experimental results and other calculations. (auth)

22611 AERE-R-2976
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
RECENT DEVELOPMENTS IN LIGHT SOURCES EXCITED BY MICROWAVES. L. Bovey and H. Wise. July 1959. 9p. $0.35(BIS).

Alterations in preparation of tubes and direction of microwave power into them for the excitation of spectra are described. A cavity resonator type of excitor gives intense spectra of uranium and plutonium without the need of an auxiliary furnace when tubes containing the iodide are used; sections of plates showing isotope shifts in lines from U^{235}, U^{236}, U^{238}, Pu^{239}, and Pu^{240}, respectively, are shown. (auth)

22612 AERE-R-2982
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE IMPORTANCE OF MULTIPLE BRAGG SCATTERING FOR NEUTRON CRYSTAL SPECTROMETERS. H. J. Hay. July 1959. 17p. $0.35(BIS).

Measurements of the variation of intensity with wavelength for coherent scattering of neutrons from beryllium crystals has shown that the average intensities in different orders and from different planes are in agreement with calculated values of the relative reflectivities. However, a detailed study of the neutron energies and crystal orientations has shown that double Bragg reflections may contribute an appreciable fraction of the total intensity. With planes like (111), for which the odd order reflections are absent, double reflections give a large proportion of neutrons having one quarter of the desired energy, thereby making it difficult to attain the advantages expected from the use of these planes to produce a monochromatic neutron beam. (auth)

22613 AERE-R/R-2425
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
RIPPLE: A METHOD OF COMPUTING THE THERMAL NEUTRON FINE STRUCTURE FOR THIN PLATE ASSEMBLIES. D. A. Newmarch. July 1959. 23p. $0.49(BIS).

The details are given of the RIPPLE program for computing the fine structure in infinite assemblies. Comparisons are made with the spherical harmonics method and a method due to P. B. Daitch. The spherical harmonics method does not appear to be satisfactory for thin plates unless a high order of approximation is used; it tends to underestimate the magnitude of the fine structure. For the case calculated, RIPPLE and the method of P. B. Daitch give very good agreement. The advantage of the RIPPLE method is that it can manage complicated fuel arrays without difficulty, (e.g., two types of fuel plates with sheaths and different thicknesses of moderator between). The disadvantage of the RIPPLE method is that it cannot allow for non-isotropic scattering, but this does not appear to be important. (auth)

22614 AFCRC-TN-59-200
Air Force Cambridge Research Center. Geophysics Research Directorate, Mass.
OBSERVATIONS ON NICKEL–BEARING COSMIC DUST COLLECTED IN THE STRATOSPHERE. GRD Research Notes No. 9. Herman Yagoda. Dec. 31, 1958. 16p. Project 8600. (AD-212422).

Stratospheric dust particles collected on plastic surfaces were examined microchemically for the presence of nickel using dimethylglyoxime as a specific developing reagent. Samples collected from four balloon flights with plateau elevations between 77,000 and 112,000 feet indicate the deposition of 0.17 to 0.36 nickel bearing particles per cm^2 per day of exposure. Most of the color reactions for nickel vary between 20 and 40 microns diameter, but some dust particles as small as 1 or 2 microns have given positive reactions. Experimental details of the technique are described. (auth)

22615 AFOSR-TN-58-748
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
PHOTOELASTIC STUDY OF STRESS WAVE PROPAGATION IN LARGE PLATES. J. W. Dally, A. J. Durelli, and W. F. Riley. Nov. 5, 1958. 30p. Contract AF18(603)-144. (AD-162271).

Dynamic photoelastic methods with a low modulus urethane rubber compound as the model material were employed to study wave propagation in large plates. The loading was accomplished by using small package

explosives in the form of electrical primers. The charges were placed at the corner and center of one long side of a large rectangular plate. It was found that the photoelastic fringe patterns could in certain cases be related to the dilatational and distortional waves produced by the explosion. The effect of the reflection of the dilatational wave at glancing incidence was to increase the boundary fringe order at the leading edge of the wave by about 50%. The maximum fringe order which moved along an interior line decayed as it propagated away from the point of load application as a function of $(1/r^{\frac{1}{2}})$. (auth)

22616 AFOSR-TN-59-488

General Electric Co. Flight Propulsion Lab. Dept., Cincinnati.

HIGH TEMPERATURE HEAT TRANSFER FROM GASES TO CYLINDERS AND NOZZLES. [Period covered]: February 1, 1958 to February 28, 1959. I. E. Kanter, F. Martinek, and M. L. Ghai. 135p. Contract AF49(638)-243. (AD-215841).

A gas stabilized plasma generator operating with nitrogen gas and water-cooled metal electrodes was successfully operated to supply the hot gas necessary for this study. The required instrumentation has been, or is being, developed to measure the various temperatures, flow velocities, and power consumption rates experienced with the generator and associated equipment. Preliminary temperature traverses and photographic studies were made to investigate the flow field of the effluent gas. Calculations are presented for the thermodynamic properties of nitrogen gas at high temperatures including the pressure effect. Also included are the general considerations on experimentation and data reduction as pertains to this study. (auth)

22617 AMC-TR-59-7-589(Vols.I and II)

Owens-Corning Fiberglas Corp. Reinforced Plastics Lab., Ashton, R. I.

CONTROL OF VARIABLES IN HEAT RESISTANT GLASS REINFORCED PLASTICS. VOLUME I. SUMMARY REPORT. Ralph H. Sonneborn, Allan B. Isham, and Frank W. Dennen. VOLUME II. ENGINEERING REPORT. Ralph H. Sonneborn, Allan B. Isham, Richard H. Wagner, and Frank W. Dennen. Jan. 1959. (Vol.I, 66p. and Vol.II, 583p.). Contract AF33(600)-35031. $1.75, Vol.I and $7.00, Vol.II (OTS).

These two volumes, issued separately, but cataloged as a unit may be further identified as AD-156069 [Vol.I]; PB-151802; AD-156069[Vol.II]; PB-151803, respectively.

The widespread use of reinforced plastics in structural applications has been hampered because of inconsistencies in properties of molded parts. Much of the inconsistency is caused by lack of precise knowledge of the variability associated with the materials and production processes. The effects of these types of variables on laminate properties were determined. Eight resin systems were investigated: a conventional liquid polyester, a conventional polyester prepreg, a heat resistant polyester, a conventional epoxy, a heat resistant epoxy, a low pressure heat resistant phenolic, a high pressure heat resistant phenolic, and a heat resistant silicone. Five types of fibrous glass reinforcement were studied: roving and yarn for unidirectional reinforcement, and the 181, 143, and 120 styles of woven fabric. Three fabric and yarn size removal systems were investigated, as well as the application techniques for five finishes: Volan A, Garan, 301, 136, and A-1100. Laminates in three thicknesses from 0.050 to 0.400 inches were covered. These were made by four conventional molding processes: vacuum bag, pressure bag, autoclave, and press molding. In addition, parallel strand molding was studied. The hot, wet, and dry properties of these panels were determined, and the standard deviations found. The conditions for making the highest quality panels for specific properties are stated, together with their statistically reliable values. The causes and extent of variations are given. Standard test, inspection, and quality control methods are evaluated. Also commercial and developmental nondestructive techniques are reviewed. (auth)

22618 ANL-6038

Argonne National Lab., Lemont, Ill.

PHYSICS DIVISION SUMMARY REPORT [FOR] JULY–AUGUST 1959. Aug. 1959. 50p. Contract W-31-109-eng-38. $1.50(OTS).

Experiments done with the Van de Graaff generator are listed. Improvements and generator troubles are discussed. Most of the small resonances up to 350 kev in Na^{24} were studied by self-detection measurements and the analysis of the resonances is in progress. The analyses were completed in the region from 180 to 350 kev and the results are included. Preliminary studies on dissociation of multiple-charged DBr^{80} ions formed by isomeric transition of 4.4-hr Br^{80m} indicate that less than 5% of the DBr ions of each charge greater than +3 remain bound. Atomic ions of Br with charges from +1 to +10 were observed. The complete crystal structure of sodium uranyl acetate was determined. The dimensions of the Li_2WO_4 unit cell were measured. A precise determination of all atomic positions is under way. It was found that the statistical properties of the excited states of some complex atoms are the same as those which have previously been discussed for neutron resonance states. The assumption that space-time possesses the symmetry of the DeSitter group is being studied to develop the physical consequences for the properties of elementary particles. A possible formalism that explains the difference between the masses of the charged and neutral species of both π- and K-mesons is proposed. (For preceding period see ANL-6020.) (auth)

22619 ANL-6061

Argonne National Lab., Lemont, Ill.

THE RELATION BETWEEN REGRESSION COEFFICIENTS IN A MULTIPLE-REGRESSION ANALYSIS. James E. Monahan. Sept. 1959. 19p. Contract W-31-109-eng-38. $0.75(OTS).

In a multiple-regression analysis it is often necessary to assign a value, different from the least-squares value, to one or more of the regression coefficients. A simple method is described which eliminates the matrix algebra which, in such cases, is usually necessary in order to re-evaluate the remaining coefficients, together with the associated variances and covariances. The method is generalized to give an equally simple procedure for testing possible linear relations among the regression coefficients. (auth)

22620 APEX-507

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

COMPARISON OF COMPUTED CENTERLINE DOSE RATES FROM DIFFERENT AREAS OF A SOURCE PLATE. A. W. Casper and J. G. Carver. Nov. 1958.

30p. Contracts AF33(600)-38062 and AT(11-1)-171. $1.00(OTS).

A shield fixture that consists of a slab of iron with a cylindrical hole into which plugs of various materials can be inserted is described. Computations made to determine the effect of source-plate size on centerline dose rates are described, and incremental dose contributions from various annular sections of the source plate are presented. Plugs of iron, aluminum, and lead were used in the computations. (auth)

22621 APEX-521

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

SEDP-SYNTHETIC EXPERIMENT DESIGN PROGRAM. F. D. Wenstrup. Nov. 1958. 43p. Contracts AF33 (600)-38062 and AT(11-1)-171. $1.25(OTS).

Programming techniques, input data, and output data are described for the Synthetic Experiment Design Program (SEDP), which is a mechanized, parametric study method for the IBM 704. The first part of the program takes as input a table of independent variables and their corresponding upper and lower limits. The program generates and provides as output the combinations of actual values of the independent variables that constitute the synthetic experiments. Part two of SEDP takes the output of part one, together with the values of the synthetic observations of the dependent variable, and evaluates by least squares the coefficients of a quadratic equation giving the empirical relationship between the chosen independent variables and the dependent variable. The maximum number of independent variables that can be used is eight. The equations for the evaluation of the coefficients require that the independent variables be orthogonal, i.e., linearly independent. (auth)

22622 ARDC-TR-57-46(Vol. 1)

Florida. Univ., Gainesville.

PROCEEDINGS OF THE FLORIDA CONFERENCE ON HIGH-SPEED AERODYNAMICS AND STRUCTURES HELD AT THE UNIVERSITY OF FLORIDA, GAINESVILLE, FLORIDA, JANUARY 21-24, 1957. 200p. (AD-113003; PB-151538). $3.50(OTS).

The conference brought together nearly 300 aerodynamics, thermodynamics, and structures engineers for an exchange of new information on practical problems pertaining to high-speed flight. Paths that are being taken in developing aerodynamic and structural designs and work to prove the reliability of these designs are discussed. (W.D.M.)

22623 ARGMA-TN-1H-1N-3(Rev.)

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.

ONE-DIMENSIONAL COMPRESSIBLE FLOW TABLES FOR A PERFECT GAS IN MACH NUMBER INCREMENTS OF 0.01 (k = 1.40) ADIABATIC FLOW WITH FRICTION. C. Hoebich. Apr. 1959. Revised Aug. 1959. 91p.

Functions of Mach numbers for compressible perfect gas are tabulated. The ratio of specific heats (k) is 1.40. The increment used in these tables is sufficiently small (0.001 Mach number) to eliminate interpolation. Adiabatic flow in constant area ducts with friction is covered. (auth)

22624 BM-RI-5510

Bureau of Mines.

LOW-TEMPERATURE HEAT CAPACITY AND HIGH-TEMPERATURE HEAT CONTENT OF CEROUS FLUORIDE. E. G. King and A. U. Christensen. Apr. 1959. 10p.

The results of low-temperature heat-capacity and high-temperature heat-content measurements for cerous fluoride (CeF_3) are reported. The low-temperature heat-capacity data cover the temperature range 51 to 298°K and serve to evaluate the entropy at 298.15°K. The high-temperature heat-content data cover the temperature range 298 to 1,799°K, including the temperature and heat of fusion. The results are assembled for ready use in thermodynamic calculations. Cerous fluoride is one of the important intermediate compounds in the production of cerium metal. (auth)

22625 CENC-1038

Combustion Engineering, Inc. Nuclear Components Engineering Dept., Chattanooga.

SODIUM COMPONENT STUDY. Feb. 1959. 292p. Contract AT(11-1)-665. $45.00(ph), $11.10(mf) OTS.

A design study is presented of a heat exchanger system to produce superheated steam from a source of heated, radioactive Na. The purpose of the study was to produce a conceptual design of a less expensive and more reliable heat exchanger and steam generator of advanced design and improved performance for use in sodium-cooled reactor systems. The study was based on a 70-Mwh steam generator and a 70 Mw heat exchanger. Superheated steam at 1050°F and 2200 psig will be produced from 600°F feedwater. The heat source will be radioactive Na cooled from 1200 to 700-900°F. (T.R.H.)

22626 CU-192

Columbia Univ., New York.

NEUTRON CROSS SECTIONS OF TELLURIUM (thesis). Clifford J. Heindl. June 30, 1959. 77p. Contract AT-30-1-GEN-72. $2.00(OTS).

The total neutron cross section of tellurium was measured over the range 0.5 ev to several hundred ev, and shows the presence of resonances at 2.34 ev, 25 ev, near 65 ev, and near 250 ev. Similar data on samples of the enriched isotopes indicate that the resonances at 2.34 ev and near 65 ev are due to Te^{123}, and that at 25 ev is due to Te^{125}. Te^{123} also gives the only measurable contribution to the structure near 250 ev. Breit-Wigner parameters for the large 2.34 ev resonance are found, from measurements of σ_t and σ_s/σ_t over the nearby energy region, to be $\sigma_0 = 730$ b, $\Gamma = 0.11$ ev, $\Gamma_N^0 = 0.011$ ev, effective nuclear radius of resonant spin state $R = 7.0 \times 10^{-13}$ cm, spin of resonant state $J = 1$. The coherent scattering cross section determined by reflection of very low energy neutrons ($\lambda \approx 4.4$ Angstrom units) from tellurium mirrors was 4.0 barns. Forward scattering of subthermal neutrons gave a value 0.7 barns for the incoherent scattering cross section. The free scattering cross section found from extrapolation of transmission data in the 1/v region was 4.5 barns. (auth)

22627 EFINS-59-35

Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies and Argonne National Lab., Lemont, Ill.

PARAMAGNETIC RESONANCE ABSORPTION IN NEPTUNIUM HEXAFLUORIDE. Clyde A. Hutchison, Jr. and Bernard Weinstock. 1959. 25p. $4.80 (ph), $2.70(mf) OTS.

The paramagnetic resonance absorption of crystalline NpF_6 was studied at 3 cm wave length and at the boiling point of liquid He. The data were fitted to the spin Hamiltonian. The parameters are isotropic within

the errors of the measurements, with $g = -0.604$ and $|A/hc| = 0.1100\ cm^{-1}$. These results are interpreted in terms of the configuration f^1 perturbed by spin-orbit coupling and an octahedral molecular potential. The relationships of the present results to optical data and measurements of magnetic susceptibility for the same substance are discussed. Hyperfine structure due to F is observed and is anisotropic. (auth)

22628 HW-60220

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

NUCLEAR PHYSICS RESEARCH QUARTERLY REPORT, JANUARY, FEBRUARY, MARCH 1959. Apr. 20, 1959. 84p. Contract W-31-109-Eng-52. $2.25(OTS).

A method is presented for obtaining information about neutron temperature. The method depends on the variation, with neutron temperature, of the ratio of the fission cross section of Pu^{239} and U^{235}. Measurements were made of the fission activity of Pu^{239} and U^{235} foils in the TTR thermal column at moderator temperatures of 18 to 650°C. In a comparison of UK, French, and US graphite purity standards, measurements of the absolute and comparative cross sections for various samples of graphite were completed and are summarized. Measurements in graphite-uranium lattices of buckling for rod diameters 0.925, 1.175, 1.36, and 1.66 inches were completed. Material buckling measurements for several graphite-uranium lattices with 1.92 and 2.5 inch diameter natural uranium fuel elements were completed. The measurements were made in exponential piles having dimensions of 4 × 4 or 4 × 5 feet in cross section. Both air and water coolants were used. A measurement of k_∞ for a 2% enriched UF_4-paraffin mixture is reported. The critical approach measurements with 3.063% enriched uranium rods in light water were continued. Results on 0.300-in. diam rods are reported. The processing of power reactor fuels of enrichments up to 3% has been scheduled for facilities at HAPO. Values of k_∞ at this enrichment are required for UO_3 and $UO_2(NO_3)_2$ hydrogen-moderated systems to permit the specification of critically safe conditions for this operation. A series of exponential experiments was made with 1.25% enriched uranium fuel elements to obtain further critical mass information on slightly enriched uranium. Elements were 1.336 OD, 0.500 ID, and 7.5 inches long. The thermal neutron flux in nonabsorbing heavy gas media with temperature discontinuities is considered. The two geometries of interest are (a) an infinite cylinder at temperature T_1 surrounded by an infinite medium at temperature T_2, and (b) an infinite slab at temperature T_1 imbedded in an infinite medium at temperature T_2. Diffusion coefficients for simple heterogeneous systems are computed. (For preceding period see HW-59126.) (W.D.M.)

22629 IDO-16531

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

ETR THERMAL NEUTRON FLUX MEASUREMENTS. L. D. Weber and C. H. Hogg. Sept. 23, 1959. 330p. Contract AT(10-1)-205. $5.00(OTS).

The thermal neutron fluxes in selected positions of the ETR were measured for cycles 11, 6, 3, 2, 1 and on November 4, 1957 (post neutron test). Flux maps of the tank and traverses for all positions monitored are shown for each cycle. The measurements for cycles 6 and 2 include data for a clean core, a partially depleted core, and a fully depleted core. (auth)

22630 LA-2299

Los Alamos Scientific Lab., N. Mex.

X-RAY CRYSTALLOGRAPHIC INTENSITY FUNCTIONS. Charles P. Kempter, Dorothy L. Cooper, and Thomas L. Jordan, Jr. Feb. 1959. 110p. Contract W-7405-eng-36. $18.30(ph), $6.00(mf) OTS.

Several functions used in the calculation of x-ray crystallographic intensities are tabulated over large ranges. These tabulations include Lorentz-polarization factors as a function of Bragg angle, the Debye function as a function of Θ/T, and the Debye-Waller temperature factor as a function of B for selected $\sin\theta/\lambda$ values. (auth)

22631 MND-P-2101

Martin Co. Nuclear Div., Baltimore

SNAP-III — THERMOELECTRIC GENERATOR ENVIRONMENTAL TEST. Louis W. Gross. Aug. 1959. 68p. $10.80(ph), $3.90(mf) OTS.

The effects of simulated space vehicle vibration, acceleration, and shock on the operation and efficiency of a SNAP-III thermoelectric generator are described. The test specifications were developed by Jet Propulsion Laboratories for the third stage and payload of the Vega Vehicle. (auth)

22632 MND-P-2514

Martin Co. Nuclear Div., Baltimore

SNAP-III — THERMOELECTRIC GENERATOR SAFE HANDLING PROCEDURES. Thaddeus J. Dobry, Jr. and Paul Guinn. Apr. 1959. 18p. $3.30(ph), $2.40(mf) OTS.

A method for the safe handling of the SNAP-III thermoelectric generators is presented. It provides information regarding shipping regulations, general handling instructions for packing, unpacking, and demonstrating the device, and procedures to follow in an event of an accident. Possible hazards involved in handling the device, and the probability of any of these hazardous incidents occurring while it is being demonstrated, are summarized. Containment of the radioisotope fuel used in the SNAP-III device was assured under rigorous conditions, including short time external thermal temperature excursions to 1600°C, when in the shipping container. The probability of the device encountering such temperatures are remote. (auth)

22633 MPL-M-1

Sylvania Electric Products Inc. Microwave Physics Lab., Mountain View, Calif.

PRINCIPLES OF MICROWAVE INTERACTIONS WITH IONIZED MEDIA. R. F. Whitmer. Dec. 16, 1958. 27p. For Boeing [Airplane Co.]

The basic concepts of electromagnetic wave propagation in the presence of an ionized gas in an external d-c magnetic field are discussed. The discussion has purposely been restricted to elementary considerations and therefore is not completely rigorous. It is intended to serve as an introduction to these problems upon which more rigorous and detailed theories can be based. Part I discusses the concept of plasma resonance and Part II discusses the effects of electron cyclotron resonance on electromagnetic wave propagation. (auth)

22634 MRL-61

Watertown Arsenal. Materials Research Lab., Mass.

X-RAY INCOHERENT SCATTERING FUNCTIONS FOR NON-SPHERICAL CHARGE DISTRIBUTIONS: N, N^-, O^-, O, O^+, O^{+2}, O^{+3}, F, F^-, Si^{+4}, Si^{+3}, Si, and Ge. A. J.

Freeman. Jan. 1959. 27p. DA Project No. 5-93-32-001. (AD-210838).

The atomic incoherent scattering functions of N, N^-, O^-, O, O^+, O^{+2}, O^{+3}, F, F^-, Si^{+4}, Si^{+3}, Si, and Ge were calculated according to the Waller-Hartree theory as extended in a previous paper to include the effects of the inherent non-sphericity of the atomic charge distributions. Hartree-Fock wave functions were used in all the computations. The results obtained show large deviations from the previously reported values of James & Brindley. These differences arise mainly from the inclusion in the present calculations of all the exchange integrals in the Waller-Hartree expression. (auth)

22635 NAA-SR-Memo-4126

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ENERGY RELEASE FROM THE DECAY OF FISSION PRODUCTS. P. Speigler. July 31, 1959. 10p. $1.80(ph), $1.80(mf) OTS.

The beta-ray energy release, gamma-ray energy release, and gamma-ray energy spectrum were calculated as a function of time after shutdown for fission products due to thermal neutron fission of U^{235}. Calculations were carried out for reactor operating times of 100 hours, 1000 hours, and for an infinite operating time. Only the results for infinite operating time are given since it is possible to obtain from them the results for any finite operating time. (auth)

22636 NASA-M-5-12-59E

National Aeronautics and Space Administration. Lewis Research Center, Cleveland.

ANALYTICAL INVESTIGATION OF THE EFFECT OF TURBOPUMP DESIGN ON GROSS-WEIGHT CHARACTERISTICS OF A HYDROGEN-PROPELLED NUCLEAR ROCKET. Harold E. Rohlik and James E. Crouse. June 1959. 38p.

Axial-flow, mixed-flow, and centrifugal pumps driven by single- and twin-turbine drive systems were investigated for application in a high-pressure bleed-type turbopump unit. The effects of turbopump weight and turbine flow rate required for each type are shown in terms of the ratio of rocket gross weight to payload for a fixed mission. (auth)

22637 NP-7907

Tung-Sol Electric, Inc., Bloomfield, N. J.

UTILIZATION OF SELF-SUSTAINED ELECTRON EMISSION INVESTIGATION. Quarterly Report No. 1 [for] October 1, 1958–December 31, 1958. B. G. Firth. 34p. DA Project No. 3-99-15-022. Contract DA-36-039-SC-78081.

MgO cathode surface potentials for parallel plates 2 cm sq. and 4 mm apart were measured in the order of 145 to 190 volts for plate potentials of 151 to 211 volts. The surface potential tends to follow the plate potential, deviating somewhat with rise in current. The reason why wire and mesh grids close to the MgO cold cathode are far more effective for starting and sustaining emission than a solid plate is discussed. The first cathode ray tube gun was made. It required an emission sustaining grid. Self-sustained emission currents were measured down to 0.002 microampere, or 0.00082 $\mu a/cm^{-2}$ at voltages down to 80 volts. Restarting is slow. Fast, reliable restarting requires 2 to 4 microamperes per sq. cm sustaining current for cathodes presently made. Audio power amplifier tubes type DT-812B with Gm = 600 μmhos and 900 milliwatts audio output were made far more stable in operation. Possibilities of improved characteristics are indicated. Cathode noise and development are discussed. (auth)

22638 NP-7908

Tung-Sol Electric, Inc., Bloomfield, N. J.

UTILIZATION OF SELF-SUSTAINED ELECTRON EMISSION INVESTIGATION. Quarterly Report No. 2 for January 1, 1959–March 31, 1959. B. G. Firth. 22p. DA Project No. 3-99-15-104. Contract DA-36-039-SC-78081.

Completion of the magnetic analysis of electron energy distribution from the MgO self-sustained emission cathode shows a peak at 13.5 volts and 90% of electrons less than 65 volts. The curve is believed to give an energy distribution accurate to a few volts. The main portion of the curve fits very closely a Maxwellian distribution. Preliminary cathode ray guns were operated with beam currents of 0.3-0.5 ma with control grid at 300-400 volts and collector at 1500 volts. The next gun is to be an improved design for use in a complete cathode ray tube. Mesh dynodes for the secondary emission preamplifier were made with an effective delta of 3. A new Type "B" design of secondary emission tube and a device for evaluating dynodes is on the way. A new Type DT-812C audio output amplifier tube is being designed to be more effective than the present DT-812B. It is hoped to exceed the 600 micromhos Gm of the latter. Control grid current should be lower and input impedence higher. (For preceding period see NP-7907.) (auth)

22639 NP-7909

University of Western Ontario, London.

FINAL REPORT TO THE OFFICE OF NAVAL RESEARCH FOR SEPTEMBER 1, 1958 TO AUGUST 30, 1959. R. Stevenson. 35p. Contract Nonr-2665(00).

A summary is presented on work done under an O.N.R. contract on properties of solids in intense magnetic fields. A high field magnet was built and put into operation. A technique for measuring magnetic susceptibility in the intense fields and over short time intervals was developed. Theoretical studies indicate that Faraday effect measurements are not useful in the very intense fields for obtaining values of the effective electron mass. However, it appears that Kerr effect measurements may give useful information about intense field electron mobility. An attempt to observe infrared cyclotron resonance in some semiconductors has shown progress. (W.D.M.)

22640 NP-7916

Duke Univ., Durham, N. C.

DUKE MICROWAVE LABORATORY REPORT NO. 26 FOR MAY 1, 1959–AUGUST 1, 1959. 36p. Project No. R-357-10-6. Contract AF18(600)-497.

With this are bound: STIMULATED EMISSION OF RADIATION BY RELATIVISTIC ELECTRONS IN A MAGNETIC FIELD. Jürgen Schneider. Published in Phys. Rev. Letters 2, 504-5(1959). (AFOSR-TN-59-864); STIMULATED EMISSION OF RADIATION BY ELECTRONS IN A MAGNETIC FIELD. Jürgen Schneider. (AFOSR-TN-59-863); STIMULATED EMISSION OF RADIATION BY ELECTRONS IN A MAGNETIC FIELD; RELATIVISTIC EFFECTS. Jürgen Schneider. (AFOSR-TN-59-862); MILLIMETER WAVE SPECTRUM AND STRUCTURE OF FORMYL FLUORIDE. Paolo Favero, Anna Maria Mirri, and John G. Baker. (AFOSR-TN-59-865).

Two possible schemes for observing MASER action

by electrons moving in a magnetic field are proposed and treated theoretically in three short technical reports which are included. Pure rotational transitions of formyl fluoride (FCHO) were measured in the millimeter wave range from 90 to 160 kMc/sec. From these measurements the principal moments of inertia and molecular dimensions of the molecule were determined. Attempts are being made to construct a molecular beam maser which will operate in the shorter millimeter and submillimeter wave region. The high-temperature molecular beam spectrometer was redesigned and reconstructed in the hope of increasing its sensitivity. The new model is nearing completion. (See also AD-153951.) (auth)

22641 NP-7033
New York Univ., New York. Coll. of Engineering.
ACCURATE THOMAS-FERMI POTENTIAL DISTRIBUTIONS FOR THE ALKALI IONS. Technical Report No. 3 [on] ELECTRON SCATTERING PROJECT. Harvey J. Brudner. June 15, 1959. 42p. Contract Nonr-285(15).

Accurate solutions to the Thomas-Fermi equation for the positive alkali ions are presented. Tables of the dimensionless potential vs. the dimensionless length are presented for Li^+, Na^+, K^+, Rb^+, and Cs^+. The tabulated values are accurate to better than 1 part in 10^5. The statistical model of the atom is reviewed, and the method used to obtain the solution is described in detail. The tables presented can be used to determine corresponding Thomas-Fermi charge distributions. (auth)

22642 NP-7935
Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.
AN ANALYSIS OF THE SOLAR DAILY VARIATIONS OF THE PRIMARY COSMIC RADIATION MEASURED WITH THE IGY NEUTRON MONITOR NETWORK. Lêda A. de Moura, Georges Schwachheim, and Erich R. Willner. 1959. 17p. (Notas de Física, Vol. V, No. 9).

A study of the solar daily variation of the cosmic ray nucleonic component was made by performing harmonic analysis of the monthly averaged data from neutron monitor stations. Pressure corrected data recorded during the IGY were used. It was observed that the amplitude of the daily variation, averaged over monthly periods, has large variations from period to period, which are of worldwide character; however, the time of maximum for each given station remains practically constant. Attention is given to the dependence of the amplitude with latitude. The results show no outstanding variation from equator to about 60° geographic, and a rapid drop for higher latitudes. The time of maximum amplitude shifts gradually from early to late afternoon hours with increasing latitude. A comparison of data from northern and southern latitudes shows no asymmetry either in amplitude or time of maximum. (auth)

22643 NYO-4884
Western Reserve Univ., Cleveland.
THE THEORETICAL CALCULATION OF THE HEAT OF ADSORPTION FOR GASES PHYSICALLY ADSORBED ON CARBON SURFACES. E. L. Pace. Sept. 28, 1959. 27p. Contract AT(30-1)-824. $4.80 (ph), $2.70(mf) OTS.

The results of theoretical computations of the differential heat of adsorption for the low boiling gases, nitrogen, argon, neon, orthodeuterium, parahydrogen and helium (He^4), adsorbed on a graphite surface are compared with the experimental values which have been observed for these gases adsorbed on finely divided graphitic surfaces. The role of the zero point energy in the heat of adsorption is discussed. In the case of parahydrogen and orthodeuterium, the difference in the zero point energies arising from the difference in masses accounts satisfactorily for the higher heat of adsorption observed for orthodeuterium. The effect of energy barriers in the surface on the heat of adsorption is considered. For the particular case of a graphitic surface, it is shown that the energy barriers are small, and therefore, a "liquid like" behavior is reasonable for the adsorbed layers. With this behavior as a basis, an application of simple lattice-liquid theory for the characterizing of the differential heat of adsorption on a graphitic surface for surface coverage to approximately two monolayers is carried out. (auth)

22644 OOR-974.6
Southern Illinois Univ., Carbondale.
HEAVY PRIMARY COSMIC RAYS. Final Technical Report. Otis B. Young. [1959]. 93p.

Techniques for processing 600 micron thick electron sensitive nuclear emulsions are described and suggestions are given for beginners in emulsion plate scanning adapted to heavy nuclear projects. Since the chief way to identify heavy nuclei which produce tracks in emulsions involves delta rays, considerable attention is devoted to a procedure which will give consistent results. The charge identification of heavy nuclei by use of emulsions of different sensitivities is also discussed. Data regarding heavy primary cosmic rays at geomagnetic latitude of 41°N near the geomagnetic equator, and at g.m. latitude of 55°N are presented. The relationship between ground level neutrons and high altitude heavy primary cosmic rays is discussed. (auth)

22645 OOR-1784.6
California. Univ., Los Angeles.
TECHNIQUES FOR CALCULATIONS OF FRACTIONAL PARENTAGE COEFFICIENTS AND NUCLEAR MATRIX ELEMENTS. Technical Report No. 3. P. S. Kelly. June 1959. 95p. Contract DA-04-495-ORD-913.

Explicit and recursion formulas for one- and two-particle fractional parentage coefficients are given. The formulas cover single and mixed configurations in j-j coupling. Extension to L-S-T and J-T coupling is immediate. For mixed configurations, matrix element formulas are given which usually involve less labor than the straightforward use of mixed configuration fractional parentage coefficients. (auth)

22646 OOR-2064.1
California. Univ., Los Angeles. Dept. of Engineering.
THE EFFECT OF THE ELASTIC INTERACTION ON THE RATE OF CLUSTER GROWTH. Report No. 59-37. W. Grupen, R. Kikuchi, and George Sines. June 1959. 23p.

The effect of the elastic interaction on the rate of cluster growth in solids with point defects was studied. In the analyses the defect concentration is assumed to be such that when a defect reaches a cluster it permanently attaches itself. The clusters are assumed to exist before the analysis starts, and the elastic medium is assumed to be isotropic. (T.R.H.)

22647 ORNL-2828
Oak Ridge National Lab., Tenn.
TABLES FOR A SEMI-INFINITE CIRCULAR CURRENT SHEET. Nancy B. Alexander and Arthur C. Downing. Oct. 13, 1959. 183p. Contract W-7405-eng-26. $3.00 (OTS).

The concept of an ideal current sheet is frequently

useful in the design of electromagnets. Since a current sheet of any length can be represented by the superposition of two semi-infinite sheets, it is desirable to have tables for the magnetic field produced by a semi-infinite current sheet. The tables presented include both the magnetic field intensity and the magnetic vector potential. To use the tables it is not necessary to apply the symmetric properties of the fields. This doubles the size of the tables but greatly simplifies their use. (auth)

22648 ORO-SP-108

Johns Hopkins Univ., Bethesda, Md. Operations Research Office and System Development Corp., Solana Beach, Calif.

TABLE OF EXPONENTIALLY DISTRIBUTED PSEUDO-RANDOM NUMBERS. Betty W. Holz and Charles E. Clark. July 1959. 232p.

A table of pseudo-random numbers from the exponential distribution whose probability density is e^{-x}, $0 \leq x < \infty$ is presented. A distinctive feature of the table is the presentation of statistics of subsets of the numbers that can be used to increase the efficiency of a Monte Carlo analysis through stratified sampling. In addition, a description and proof of the generation process used, an exposition of the procedures used in performing tests of randomness of the numbers generated, and a summary of the results of the tests are presented. (auth)

22649 SC-4354(TR)

Sandia Corp., Albuquerque, N. Mex.

EXPERIMENTAL DETERMINATION OF THE PRESSURE DROP THROUGH A PEBBLE BED. D. E. Randall and S. S. Millwright. Sept. 1959. 15p. $0.75 (OTS).

The pressure drop associated with the flow of air through a cylindrical bed of spherical pebbles has been investigated experimentally. The results of this investigation are reported here. (auth)

22650 SCTM-16-56(14)

Sandia Corp., Albuquerque, N. Mex.

REVIEW OF MILLIMETER WAVE ATTENUATION CHARACTERISTICS. R. K. Moore. Jan. 23, 1956. 7p. $1.80(ph), $1.80(mf) OTS.

A brief review of knowledge of millimeter wave radio propagation indicates that attenuations as high as 60db/mile may be present during heavy rain in the 6mm oxygen absorption band. This precludes use of such wavelengths for any highly reliable system where the over-all path exceeds about 4000 feet. For very short-range systems, the possibility of security from interception or jamming may be attractive. (auth)

22651 SCTM-49-56(14)

Sandia Corp., Albuquerque, N. Mex.

THE CUMULATIVE PROBABILITY FROM DEPENDENT SAMPLES. B. L. Basore. Mar. 28, 1956. 7p. $1.80(ph), $1.80(mf) OTS.

A method of computing the cumulative probability of exceeding a fixed threshold value by a running integral of a "noisy" set of sample values is described. This method thus finds the cumulative probability when the input probabilities are not independent. It is an example of a simple n^{th} order Marchoff process. (auth)

22652 SCTM-132-56(14)

Sandia Corp., Albuquerque, N. Mex.

A NUMERICAL SOLUTION OF THE INVERSE CONVOLUTION PROBLEM. Charles S. Williams, Jr. and Robert A. Hessemer, Jr. July 3, 1956. 10p. $3.30(ph), $2.40(mf) OTS.

The convolution of the response of a linear system to unit impulse with an input time function of amplitude gives the output time function of amplitude. Frequently, the output function and response function are known and it is desired to find the input. The method described does so. The convolution integral is approximated by a sum and this result is fitted by least-squares to the known output. This leads to a set of equations linear in the ordinates of the unknown input function. It is of especial interest that the matrix of the coefficients of the linear equations is symmetrical. This means that the equations may be represented by a linear network and a solution readily obtained. Further, the coefficients along any diagonal (downward to the right) are the same; hence, the number of coefficients that must be evaluated is small. The coefficients, as well as the right-hand constant terms, represent convolutions themselves. (auth)

22653 TID-4100(1st Rev., Suppl. 4)

Technical Information Service Extension, AEC.

ENGINEERING MATERIALS LIST. A Catalog of Drawings, Photographs, and Specifications Released by the United States Atomic Energy Commission. Richard E. C. Duthie, ed. Sept. 1959. 76p.

The Engineering Materials List (EML) is a catalog of available U. S. Atomic Energy Commission unclassified engineering materials including drawings, specifications, photographs, bills of materials, cost analyses, design criteria, parts lists, and related document references. This supplement identifies additional engineering materials that have been assembled into 41 new packages totaling approximately 1,034 drawings. The Contents and the Subject, Corporate, and Drawing Number Indexes cover only materials announced in this supplement. The Indexes enable the user to locate materials by names of the organizations which originated the material, by subjects, and by original drawing identification numbers. (auth)

22654 TID-5544(Pt. B)(Del.)

Allis-Chalmers Mfg. Co., Milwaukee.

LOW POWER MOBILE NUCLEAR POWER PLANT WITH RADIOACTIVE HEAT SOURCE. PART B. 1 KW POWER PLANT FOR GROUND INSTALLATION. (Report No. 43-102). Final Report. F. B. Daniels and Eric R. Weber. June 15, 1952. Revised Oct. 10, 1952. Decl. with deletions Sept. 29, 1959. 112p. Contract AT(11-1)-196. $18.30(ph), $6.00(mf) OTS.

Studies and analyses of the problems associated with the design, development, and production of nuclear power plants of 1-kw net output for stationary ground installation, using radioactive fission products as the heat source, are presented. Calculations were made to determine the quantity of fuel required, using gross, semi-gross, and mixed fission products, and single isotopes. The relative merits of each, and the problems and cost of concentration, refinement, and separation are discussed. The studies resulted in the selection of Ce^{144} as the fuel. Several methods of power generation and types of power units were considered, resulting in the selection of a turbine-generator unit using mercury vapor as the cycle fluid. Assembly drawings of two practical arrangements are shown, with a discussion of each arrangement and its components. Details of the heat cell are given, including curves of required radioactivity, size, and shielding requirements. Included also

are estimates of fuel costs and plant development costs. (auth)

22655 UCRL-4659
California. Univ., Livermore. Lawrence Radiation Lab.
DEEP UNDERGROUND TEST SHOTS. David Griggs and Edward Teller. Feb. 21, 1956. 8p. Contract W-7405-eng-48. $0.50(OTS).

This note considers the feasibility of conducting kt-weapons tests in underground holes of such depth that the explosion will be effectively contained. Such tests would allow greater freedom in a test program by freeing the detonation of the devices from weather constraints and permitting tests at any time at which a test object is ready without the problem of fitting the bomb into a test series. Costs, advantages, and disadvantages are compared with tower shots. A trial test shot, to be included in the next Nevada test series, is recommended. (auth)

22656 UCRL-5628
California. Univ., Livermore. Lawrence Radiation Lab.
ELECTRON-POPULATION ANALYSIS AND THE DIPOLE MOMENT OF THE LiH $^1\Sigma^+$ EXCITED STATE. A. M. Karo. July 1959. Contract W-7405-eng-48. 21p. $4.80(ph), $2.70(mf) OTS.

Detailed consideration is given to some properties of the first excited electronic state. Following the analysis proposed by Mulliken, SCF LCAO-MO coefficients are used to obtain qualitative information about the electron distribution. Comparison is made with earlier work with respect to the description of the excited state in terms of the interacting configurations. In addition to the excited-state dipole moment, the effective electric moment between the ground and excited states is also calculated. From this, the oscillator strength for the first allowed transition is computed as a function of the internuclear distance. (auth)

22657 UCRL-5633
California. Univ., Livermore. Lawrence Radiation Lab.
THYRATRON USED AS COMBINATION GATE, STORAGE, AND DRIVER FOR PUNCHED PAPER-TAPE OUTPUT. Robert M. Walker. July 27, 1959. 5p. Contract W-7405-eng-48. $1.80(ph), $1.80(mf) OTS.

Design of a system to punch binary data from a pulse height analyzer on paper tape concurrent with the printing of decimal information is presented. (J.R.D.)

22658 UCRL-5652
California. Univ., Livermore. Lawrence Radiation Lab.
THERMODYNAMIC FUNCTIONS OF A PARTIALLY DEGENERATE, FULLY IONIZED GAS. Hugh E. DeWitt. Aug. 14, 1959. 56p. Contract W-7405-eng-48. $9.30 (ph), $3.60(mf) OTS.

The formalism of Glassgold, Heckrotte, and Watson for the expansion of the quantum-mechanical grand partition function has been applied to a gas of point charges. The theory was extended to a multicomponent gas of fermions and bosons, and the ring diagrams were summed to give an approximate expression for the equation of state valid for the entire temperature range. The near-classical limit (high-temperature and low-density so that the gas is only slightly degenerate) is discussed in detail, and useful formulas for numerical computation of pressure and internal energy are derived from the general ring approximation to the equation of state. By expanding the chemical potential in powers of the coupling constant e^2, it is possible to eliminate the parametric dependence of pressure and density on the chemical potential and obtain the pressure as a function of density. The classical-limit Debye-Hückel results are obtained when $\hbar$ approaches 0. A general form of the screening length is obtained with the effective screening charge as $z_i e\theta_i$, where θ_i is a measure of the degeneracy of the particle species i. The contribution to the pressure from the simplest exchange interaction valid for all temperatures is evaluated exactly. The temperature and density range for which the near-classical-limit formulas are valid is discussed. (auth)

22659 UCRL-8781
California. Univ., Berkeley. Lawrence Radiation Lab.
THE CHEMISTRY OF STIBINE (thesis). Ladislav Henry Berka. June 1959. 55p. Contract W-7405-eng-48. $1.50(OTS).

Results of the study of stibine preparation by the reaction of aqueous borohydride with Sb(III) are given. The highest yield (based on BH_4^- assuming 3 $BH_4^- \rightarrow$ 4 SbH_3) obtained was 23.6%. The vapor pressure of stibine is given at six different temperatures, from -95 to -22°C. An equation of vapor pressure vs. temperature is derived which represents the data. Temperature equations for the ΔH^0, ΔF^0, and ΔS^0 of vaporization are also derived. (auth)

22660 UCRL-8860
California. Univ., Berkeley. Lawrence Radiation Lab.
NUCLEAR SPIN AND HYPERFINE-STRUCTURE MEASUREMENTS ON THE RADIOACTIVE-IODINE AND ASTATINE ISOTOPES (thesis). Hugh Leslie Garvin. Aug. 7, 1959. 115p. Contract W-7405-eng-48. $2.50(OTS).

Atomic-beam magnetic resonance techniques were used to measure the nuclear spins of I^{123}, I^{124}, I^{126}, I^{130}, I^{132}, I^{133}, I^{135}, and At^{211}. Also, measurements of the magnetic-dipole interaction constant, and the electroquadrupole interaction constant, and the electroquadrupole interaction constant for I^{131} and I^{132} are reported. The design of the atomic-beam apparatus is described. Experimental methods and sample preparation are discussed and results are interpreted in the light of the single particle shell-model theory of nuclear structure. (J.R.D.)

22661 USNRDL-TR-352
Naval Radiological Defense Lab., San Francisco.
A SIMPLE RADIANT HEATING METHOD FOR DETERMINING THE THERMAL DIFFUSIVITY OF CELLULOSIC MATERIALS. S. B. Martin. Apr. 29, 1959. 18p. (DASA-1136).

A simple radiometric method for the determination of the thermal diffusivity of poorly conducting, sheet form materials such as cellulosic kindling fuels is described. The method is a dynamic one based on the "long time" solution of the heat conduction equation for the infinite slab with constant heat input rate, and utilizes fine wire thermocouples laminated between sheets of the material (whose diffusivity is required) to measure rates of temperature rise at various depths. The geometry of the system is designed to satisfy as many as possible of the boundary conditions imposed on the mathematical model. The magnitude of errors introduced by violating the other boundary conditions are discussed in connection with the results of measurements on α-cellulose. The value of the thermal dif-

fusivity of α-cellulose containing 2 percent carbon black and whose density is 0.68 gm/cm^3 was found to be $1.06 \pm 0.06 \times 10^{-3}$ cm^2/sec. (auth)

22662 WADC-TN-58-200
Massachusetts Inst. of Tech., Cambridge. Servomechanisms Lab.
THE EFFICIENCY OF THERMOELECTRIC GENERATORS. Jose M. Borrego, Henry A. Lyden, and John Blair. Nov. 5, 1958. 83p. Project No. 6058. Contract AF33(616)-3984. (AD-206383).

The thermoelectric effects are described, and the efficiency of a thermoelectric generator is developed based upon the assumptions that the thermal conductivity, the electrical resistivity and the Thomson coefficient are constant along the length of the material. This development differs from the usual ones presented in the literature in that the thermoelectric power is not assumed to be constant but instead is assumed to vary with temperature in a manner so that $\tau = T\, d\alpha/dT$ is a constant. The resulting expressions for the efficiency and the figure-of-merit differ slightly from those previously reported in the literature. This difference is investigated in detail with respect to the expressions developed by A. F. Ioffe. An analysis is presented concerning the dependence of the efficiency of a thermoelement upon its doping concentration and a procedure is developed for maximizing the efficiency as a function of this parameter. Lastly the case of temperature dependent κ, ρ, and τ is investigated and equations are developed by which, if the temperature dependence of these parameters is known, the material's efficiency as a thermoelectric generator can be accurately determined. (auth)

22663 WAPD-AD-TH-489
[Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh].
ANALYSIS OF PARALLEL CHANNEL TRANSIENT RESPONSE AND FLOW OSCILLATIONS. E. R. Quandt, Jr. [Apr. 1959]. 36p. $6.30(ph), $3.00(mf) OTS.

An analysis has been developed which relates, for a small transient in power, the inlet flow of a parallel channel to the surface heat flux in that channel. This result has been obtained by examining the effect of a small flux disturbance on the inlet flow. The partial differential equations describing the channel variables are linearized and solved by approximations spatially and continuously in time by Laplace Transformation. Consequently, the result is a transfer function of the form:

$$\frac{\Delta V_i}{\Delta \phi} = G(s) = -\frac{as^2 + bs + c}{s^2 + ds + w_n^2}$$

in which the constants are determined by steady-state operating conditions. Linear system control theory implies that when d = 0, the response will be oscillatory, or the flow will oscillate to an increase in heat flux. When the terms which determine d are evaluated for d = 0, the following equation results which describes the exit quality conditions necessary for a flow oscillation:

$$x_e = \frac{v_f}{v_{fg}}\left[f\frac{L}{D} + 1 + \frac{2\,x_e}{v_f/v_{fg} + x}\right]$$

This equation is a direct result of the analysis, which contains several assumptions as to the nature of the channel flow, and has not been compared with a wide range of experimental data. Consequently, its validity has not yet been confirmed completely. In the past, it has been the practice to predict flow oscillations by noting the existence of a negative slope of the ΔP–flow characteristic for the channel. Since the present results offer a different explanation, a lengthy discussion of the ΔP–flow plot is included. It is concluded from this examination that such a steady-state characteristic does not provide a physically reasonable explanation for flow oscillations. (auth)

22664 WAPD-TM-152
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
UNCOLLIDED FLUX FROM FINITE CIRCULAR AND RECTANGULAR CYLINDERS. D. C. Anderson and B. D. O'Reilly. Dec. 1958. 25p. Contract AT-11-1-GEN-14. $1.00(OTS).

Expressions are derived for the uncollided flux from finite cylindrical sources with circular and rectangular cross sections. The source density is assumed to be completely arbitrary in the rectangular case and arbitrary to within independence of the axmuth in the circular case. The circular cylinder is assumed surrounded by an arbitrary number of concentric cylindrical shields and by plane circular shields above (or below) its upper (or lower) face. The rectangular source is treated with plane laminar shields parallel to one of its faces and with coaxial cylindrical shields. For both kinds of source geometry the point of observation is taken exterior to the source but without further restriction. The final expressions for the fluxes are in the form of volume integrals; they have not been reduced. (auth)

22665 XDCL-58-7-7
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
CALCULATION OF TWO-DIMENSIONAL FLUX DISTRIBUTIONS BETWEEN ABSORBING CYLINDERS. C. L. Miller and D. S. Selengut. June 25, 1958. 11p. $3.30(ph), $2.40(mf) OTS.

A method of calculating local power perturbations adjacent to fuel elements and control rods is described. The circumferential power distribution at the surface of a fuel element was calculated and is compared with experiment. (W.D.M.)

22666 AEC-tr-3191
[PLASMA PHYSICS. ELECTRIC-ARC HEATING IN RAM-JET ENGINES BY NUCLEAR FISSION PROCESSES. NUCLEAR FISSION AND EXTREME-POWER ROCKETS. PHOTON ROCKETS]. (Various Articles by Various Authors.) Translated from Reports from the Research Inst. for Physics of Jet Propulsion, Inc. —International Session held in Fraudenstadt, from Feb. 6-8, 1956. (p.239-42). 122p. $19.80(ph), $6.30(mf) JCL.

22667 AEC-tr-3191(p.1-30)
PLASMA PHYSICS. H. Maecker. 30p.

A description of the elementary processes in a plasma element is given. An investigation of the state variables and the cooperation of all processes in the stationary state are discussed. The electric arc is used as an example since this type of arc is the only medium able to maintain a plasma in a controllable manner. Dynamics, thermodynamics, measurements, and intensity of plasmas are considered. (W.D.M.)

22668 AEC-tr-3191(p.31-47)
PLASMA FLOWS. T. Peters. 17p.

Experiments on plasma dynamic phenomena and shock waves using a plasma jet are described. In in-

vestigating an arc burning under atmospheric pressure, certain physical properties of the water-vapor plasma were measured, such as electric conductivity and radiation magnitude, over wide temperature range. (W.D.M.)

22669 AEC-tr-3191(p.48-78)
DIRECT PRODUCTION OF ELECTRICITY BY NUCLEAR FISSION PROCESSES FOR ELECTRIC-ARC HEATING IN RAM-JET ENGINES. H. J. Kaeppeler. 31p.

The mechanism of action of a nuclear battery for dynamic jet engines is treated in detail. Performance data and efficiency of this power source is investigated. Possibilities of controlling the energy production of the unit is discussed. (W.D.M.)

22670 AEC-tr-3191(p.79-107)
NUCLEAR FISSION AND EXTREME-POWER ROCKETS. F. Winterberg. 29p.

When using a gas reactor as the nuclear combustion chamber of rockets, the nuclear fuel must be pumped into the supercritical nuclear combustion chamber, from which it is expanded into a rocket nozzle. In addition to expanding the nuclear fuel plasma in a nozzle, the gas reactor could be designed as a nuclear igniter for photon rockets. The energy production per unit volume is several orders of magnitude higher than in the thermonuclear reactions. (W.D.M.)

22671 AEC-tr-3191(p.108-21)
FLIGHT MECHANICS OF PHOTON ROCKETS. Eugen Saenger. 14p.

The purely flight-mechanical processes of photon power plants in space vehicles are discussed. The potential of this system is considered in detail. It is assumed that the rocket operates with extensive or complete mass disintegration and flies in a rectilinear direction in gravity-free and resistance-free outer space. (W.D.M.)

22672 AEC-tr-3783
DISINTEGRATION OF A FLUID JET. (Zum Zerfall eines Flüssigkeitsstrahles). Constantin Weber. Translated for (Oak Ridge National Lab.) from Z. angew. Math. u. Mech. 11, 136-54(1931). 58p. (Includes original, 19p.). $9.30(ph), $3.60(mf) JCL.

The disintegration phenomena (drop and wave formation) which can be observed at moderate velocities were investigated theoretically. Rotation-symmetrical interferences lead to drop formation. The disintegration time is invariable for every liquid and jet thickness at low velocities; the disintegration length increases with the velocity. Wave formation is explained by the influence of aerodynamic forces and theoretical laws are derived which agree in character with experimental results. (J.R.D.)

22673 AEC-tr-3801
PRODUCTION OF VERY HOMOGENEOUS AXIALLY SYMMETRIC MAGNETIC FIELDS. H. Primas and Hs. H. Gunthard. Translated for Argonne National Lab. from Helv. Phys. Acta 30, 331-46(1957). 18p. $3.30(ph), $2.40(mf) JCL.

A method for the production of extremely homogeneous magnetic fields (homogeneity of the order of 1: 10^{-4}) is discussed. It is shown theoretically how the edge effect in axially symmetric magnetic fields can be compensated for with simple current shims. The influence of stochastic nonuniformities of the pole pieces on the homogeneity of the magnetic field is calculated by means of statistical methods, and the consequences for a nuclear resonance experiment with high resolution are discussed. (auth)

22674 AEC-tr-3802
LEAKTIGHTNESS AND TIGHTNESS TESTING IN NUCLEAR ENGINEERING. (Dichtigkeit und Dichtigkeitsprüfüng in der Kerntechnik). A. Thiel. Translated for Argonne National Lab. from Atomkernenergie 4, No. 2, 75-80(1959). 21p. $4.80(ph), $2.70(mf) JCL.

Vacuum system technology as used in nuclear engineering is examined. Requirements for various vacuum systems are reviewed, and sub-pressure testing methods such as the discharge tube, heat-conduction manometer, ionization manometer, halogen leak finding manometer, and mass spectrometer are described. Also, various excess pressure testing methods are described and an estimate of the sensitivity of each is given. A program for general testing is outlined, and tolerable leaks are discussed. (J.R.D.)

22675 AEC-tr-3808
ON THE STRUCTURE OF THE HEAVY METALS. (Sur Le Structure Des Métaux Lourds.) J. Friedel. Translation of report CEA-766. 23p. $4.80(ph), $2.70(mf) JCL or LC.

General conclusions concerning the structure of heavy metals are presented. These metals have for the most part, properties similar to the transition metals. In U, Np, and Pu, however, complex structures with distinct homopolar bonds are evident, after which structures analogous to those of rare earths are noted in Am and in certain phases of Np and Pu. A summary of the conclusions is presented in a diagram of melting point versus atomic number. (J.R.D.)

22676 AEC-tr-3825
SOME REGULARITIES IN THE ELECTRON PARAMAGNETIC RESONANCE SPECTRA OF ALKYL RADICALS. N. Ya. Cherniak (Chernyak), N. N. Bubnov, L. S. Polyak, Yu. D. Tsvetkov, and V. V. Voevodskii. Translated from Optika i Spektroskopiya 6, 564-5(1959). 3p. $1.80(ph), $1.80(mf) JCL or LC.

The electron paramagnetic resonance (EMR) spectra of radicals formed in hydrocarbons at 77°K by γ irradiation was studied. It was concluded that in odd-number carbon–atom hydrocarbons the hyperfine structure is well resolved and the intensities of the central components do not differ greatly. For radicals with even numbers of carbon atoms the structure is not as well resolved, however, the distribution of intensities is approximately binomial in all cases. (J.R.D.)

22677 AEC-tr-3826
EXPERIMENTS IN OBTAINING THE 102ND ELEMENT. (PART 2). G. N. Flerov. Translated by Lydia Venters (Argonne National Lab.) from a booklet of Lenin Order Inst. of Atomic Energy, Academy of Sciences, U.S.S.R., Moscow, 1959. 28p. $4.80(ph), $2.70(mf) OTS.

A review of efforts in various countries to prepare nobelium is presented, and results of experiments at the Soviet Institute of Atomic Energy aimed at more accurately determining the characteristics of this element are described. Experimental techniques are reported and Pu target contamination during irradiation by O^{16} ions is discussed along with the results of bombardment using Pu^{239} and Pu^{241} targets. (J.R.D.)

22678 AEC-tr-3837
GENERAL DEFINITION OF EFFICIENCY. P. Grass-

mann. Translated for Oak Ridge Gaseous Diffusion Plant from Chem.-Ing.-Tech. 22, 77-80(1950). 19p. $3.30(ph), $2.40(mf) JCL.

A general definition of efficiency of thermodynamic machines and processes is proposed, based on the concept of capacity, which can be derived from theorems which are listed. It is shown with several examples how efficiency concepts can be uniformly derived for arbitrary processes from this concept by means of specialization. Capacity furthermore proves to be the given scale for a graphic representation of the flow of energy in thermodynamic processes. (auth)

22679 AEC-tr-3838
THE MEANING OF INCREASE OF ENTROPY IN THE ANALYSIS OF HEAT PROCESSES. D. P. Gokhshtein (Gokhstein). Translated for Oak Ridge Gaseous Diffusion Plant from Zhur. Tekh. Fiz. 21, 1121-36(1951). 31p. $6.30(ph), $3.00(mf) JCL or LC.

The application of entropy increase to an isolated system for the purpose of analyzing heat processes is presented. The work capacity of heat, and the loss of energy from an isolated system characterize the degree of deviation of processes from the ideal more clearly than do the coefficients of useful work. The value of energy loss in an isolated system, as a derivative of its entropy increase per absolute temperature of the surrounding medium, is also more exact. The additive properties of entropy allow for an equation which characterizes the perfection of a heating system, and the operation of an apparatus, in the form of a function of the sum of variables which submit more easily to mathematical operation than does the effective coefficient of useful work. (J.R.D.)

22680 AERE-trans-11/3/5/398
THE CONNECTION BETWEEN PARTIAL AND COMMON DIFFUSION COEFFICIENTS IN METALLIC MIXED CRYSTALS. Theo Heumann. Translated for U.K.A.E.A. Atomic Energy Research Establishment from Naturwissenschaften 40, 164(1953). 2p. $1.80 (ph), $1.80(mf) JCL.

Equations to express the relationships between the partial diffusion coefficients D_A and D_B, the diffusion coefficient D calculated after Metano, and the shift of the marked weld-plane are presented. Data on diffusion in several bimetal systems are included. (J.R.D.)

22681 AERE-Trans-11/3/5/1198
THE PRESSURE DEPENDENCE OF COLUMN IONISATION BY α RAYS. E. Helbig. Translated by J. B. Sykes (U.K.A.E.A. Atomic Energy Research Establishment) from Z. Physik 116, 444-53(1940). 15p. /Handwritten MS. copy). $3.30(ph), $2.40(mf) JCL.

The pressure dependence of column ionization α-rays is investigated for air, carbon dioxide, hydrogen, argon, and mixtures of air and carbon dioxide, the direction of incidence being perpendicular to the electric field. The Hoffman vacuum-dee electrometer is used to measure the numbers of ions produced. The results are compared with Jaffe's theory of column ionization, and confirm that the theory gives the correct dependence of column ionization on pressure even when the direction of incidence is perpendicular to the electric field. Large discrepancies occur only in hydrogen and argon at low field strengths, and can easily be explained by the loss of ions resulting from diffusion to the walls of the measuring volume. The recombination coefficients for air and carbon dioxide at the pressures used are calculated on the basis of the results of measurements. For both gases α decreases with rising pressure. Since not all the constants which occur in the theory are known with sufficient accuracy, the absolute values of α may be unreliable, but the pressure dependence ought to be correct. (auth)

22682 AERE-Trans-832
AN APPROXIMATE EXPRESSION FOR GREEN'S FUNCTION IN THE BOLTZMANN EQUATION FOR NEUTRONS. Khr. Ya. Khristov. Translated by D. L. Allan (U.K.A.E.A. Atomic Energy Research Establishment) from Doklady Akad. Nauk S.S.S.R. 111, 1197-1200 (1956). 8p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 6006.

22683 CEA-tr-A-300
ELARGISSEMENT DES RAIES BALMER PAR EFFET STARK AUX DENSITÉS ÉLECTRONIQUES ÉLEVÉES. (Magnification of Balmer Lines by the Stark Effect at High Electron Densities.) H. Griem. Translated into French from Z. Physik 137, 280-94(1954). 23p.

The profiles of the Balmer lines emitted from a stabilized high-electron-density arc in water were measured at various potentials. The influence of electronic and ionic fields was undertaken with attention to clarity. This permitted the establishment of theoretical profiles with which the measured profiles agreed. The calculated data for electron densities were actually lower but of the same order as that calculated using the Holts-Marks theory. The dissymmetry of the H_β lines and the divergence of the H_γ lines were measured and explained theoretically. (tr-auth)

22684 CEA-tr-R-224
DÉTERMINATION DE LA VARIATION DU COÉFFICIENT DE CONDUCTIBILITÉ THERMIQUE EN FONCTION DE LA TEMPÉRATURE. (Determination of the Variation of the Coefficient of Thermal Conductivity as a Function of Temperature). L. A. Vuliss (Vouliss) and V. A. Potseluiko (Potzeloiko). Translated into French by Kameneev and M. B. de Trezvinsky from Zhur. Tech. Fiz. 26, 76-84(1956). 15p.

Stationary and non-stationary methods are proposed for the determination of the dependence of thermal constants on temperature. Experiments which confirm the utility of these methods were performed. (T.R.H.)

22685 CEA-tr-R-391
DISTRIBUTION À L'ÉQUILIBRE DE CHARGES D'IONS AZOTE. (Equilibrium Distribution of the Charges of Nitrogen Ions.) N. S. Nikolaev, L. N. Fateeva, I. S. Dmitriev, and Y. (Ia.) A. Teplova. Translated into French from Zhur. Eksptl'. i Teoret. 32, 965-8(1957). 11p.

The charge distribution at equilibrium was determined for a nitrogen-ion beam after passing through films of Be, Ni, Au, and celluloid at 0.95 to 9.4 Mev. The average charge variation as a function of the velocity was obtained. A slight difference was detected in the charge distribution of the various materials after penetration by the beam. (tr-auth)

22686 CEA-tr-R-712
EXCITATION DES SPECTRES DANS LA RÉGION DU VIDE PAR UNE DÉCHARGE PULSÉE À BASSE TENSION. (Excitation of Spectra in the Vacuum Region by Low Voltage Pulsed Discharge.) F. Z. Pedos and N. S. Sventitskii. Translated into French by B. de Trezvinsky from Optika i Spektroskopiya 5, 706-7(1958). 5p.

Low voltage pulsed discharges to excite spectra are

of particular interest for spectra in the extreme ultraviolet. To examine the spectra a vacuum spectrograph having a concave diffraction grating is used, installed according to the oblique incidence set-up. The slit is 0.05 mm, and a vacuum of 10^{-4} mm Hg is used. Source to slit distance is 100 mm. The spectrum is photographed on panchromatic film with a sensitivity of 300 GOST and hypersensitized by transformer oil. The utility of low-voltage pulsed discharges in this arrangement is demonstrated. (T.R.H.)

22687 ER-8868-7

ON THE MECHANICS OF PHOTONIC JET PROPULSION (English Version). Eugen Sänger. 118p. R. Oldenbourg Verlag, Munich, 1955.

This contribution to the mechanics of photonic propulsion represents the first stage of an extensive research program in the field of photon jet power plants. The fundamental differences in photon rockets and photon ramjets are pointed out and the five problems basic in photon propulsion are discussed: general relativistic jet propulsion mechanics, matter-energy transformation, gas radiation, reflection of radiation, and absorption of radiation. (W.D.M.)

22688 NP-tr-277(Pt.II)

THEORY OF IONIZATION IN COLUMNS. [PART] II. G. Jaffé. Translated by R. C. Murray (U.K.A.E.A. Atomic Energy Research Establishment) from Ann Physik (5) 1, 977-1008(1929). 35p. $6.30(ph), $3.00 (mf) JCL.

The previously developed theory of column ionization has been extended by the same method, to cover the simultaneous presence of several columns and the resulting interaction between them. Section 1 deals with the processes of recombination and diffusion, when the columns are produced once-for-all (during a very short period of irradiation). The columns are assumed parallel to one another and it is assumed that either their axes cut a plane normal to them at the corners of a rectangular lattice, or the columns fill a rectangular-section beam and are distant from each other by not more than their initial diameter. The first assumption about arrangement has as limiting cases individual columns and homogeneous ionization. Without any other assumption an equation can be deduced on this basis for the fraction of ions of each column which 'escape' from it and undergo general recombination. Section 2 deals with the case, under special simplifying assumptions, of the irradiation having been in progress for any time. This yields equations for the increase of ionization density, and for its decay after a specified irradiation time. Section 3 makes a comparison with existing experimental results. (auth)

22689 NP-tr-296

STUDIES ON FLUORIDE GLASS. II. THE SYSTEMS BeF_2-AlF_3-NaF, KF, CaF_2 (MgF_2, SrF_2, BaF_2). M. Imaoka. Translated by S. G. Brickley (U.K.A.E.A. Atomic Energy Research Establishment) from Yogyō Kyōkai Shi 62, 24-7(1954). 6p. $1.80(ph), $1.80(mf) JCL.

Reduction of hygroscopicity of beryllium fluoride–alkali fluoride glass by substituting aluminum fluoride for beryllium fluoride was investigated. It was found that transparent glass can be produced which has nd values of 1.36 to 1.40, ν values of 100 to 90, and good optical qualities with low hygroscopicity. (J.R.D.)

22690 NP-tr-297

THE MOTION OF SOLID PARTICLES IN A GAS SUSPENSION. G. N. Khydyakov. Translated by P. Kelly (U.K.A.E.A. Atomic Energy Research Establishment) from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 7, 1022-33(1953). 23p. $4.80(ph), $2.70(mf) JCL or LC.

The movement speeds of particles in gas suspension were investigated. Dependence on the Re criterion was established as well as simultaneous particle spin and forward motion. The reasons for spin and particle displacement were generally established, and it was shown that nearly all processes taking place in gas suspensions in straight downward flow are connected with non-steadiness of particle movement. (J.R.D.)

22691 SCL-T-267

STUDIES ON THE THERMAL PROPERTIES OF FIBROUS MATERIALS. I. ON THE HEAT CONDUCTIVITIES OF FIBROUS MATERIALS. Genichi Horikoshi. Translated by Noburu Hiraga (Sandia Corp.) from Sen-i Gakkaishi 13, 801-7(1957). 22p. $4.80(ph), $2.70(mf) JCL.

The relationship of the apparent heat conductivity of fibrous materials are examined, and interpretations of the results are presented. Investigations revealed that there is a sudden decline in the apparent heat conductivity of these materials in the initial stage as the compressibility of fiber becomes greater. At a specified compressibility, a gradual decrease in air pressure is accompanied by a similar decrease in apparent heat conductivity. Fibrous material heat transfer is thought of as the combined action of fibrous materials and air. (J.R.D.)

22692 SCL-T-271

THE PROBLEM OF RADIATION INFLUENCE OF SOLID BODIES. (Das Problem der Strahlenbeeinflussung von Festkörpern.) K. Lintner and E. Schmid. Translated by Marcel I. Weinreich (Sandia Corp.) from Nukleonik 1, 29-40(1958), Apr. 38p. $6.30(ph), $3.00(mf) JCL.

A survey of the effects of irradiation on the properties of crystalline solid bodies is presented. Structural changes are examined, and post irradiation behavior is discussed. A survey of literature related to the effects of irradiation on corrosion is also included. (J.R.D.)

22693 SCL-T-272

THE DIRECT PRODUCTION OF ELECTRON PAIRS BY ELECTRONS. (Über die Direkte Erzeugung von Elektronenpaaren durch Elektronen.) G. Lütjens. Translated by Marcel I. Weinreich (Sandia Corp.) from Z. Naturforsch. 13a, 510-14(1958). 12p. $3.30(ph), $2.40(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 15677.

22694 SCL-T-275

ON THE PREPARATION OF SUSPENSIONS FOR THE ULTRAELECTRON MICROSCOPE IN THE ULTRASONIC MIST. (Über die Präparation von Suspensionen für das Übermikroskop im Ultraschallnebel.) H. Kehler, A. Koch, and K. Tesser. Translated by Marcel I. Weinreich (Sandia Corp.) from Z. wiss. Mikroskop. 62, 521-4(1954/55). 7p. $1.80(ph), $1.80(mf) JCL.

Method and apparatus for use in application of fine particle coating suspensions on carrier foil are described. To prevent the tendency to cluster, a 3 Mc ultrasonic quartz field is used to atomize the particles. The coated foil is prepared in this manner for use with the electron microscope. (J.R.D.)

22695 SCL-T-274

A SIMPLE METHOD FOR THE DETERMINATION OF CHANGES OF THE WIND VECTOR IN THE 200 TO 300 m ATMOSPHERE LEVEL ABOVE THE GROUND. (Eine Einfache Methode zur Bestimmung von Änderungen des Windvektors in Den Unteren 200 – 300 m Über Grund). W. Boer and J. Kolbig. Translated by Marcel I. Weinreich (Sandia Corp.) from Angew. Meteorol. 3, 161-3(1958). 11p. $3.30(ph), $2.40(mf) JCL.

A method is presented for determining the changes of the wind velocity at various altitudes by means of vertical smoke streaks produced by smoke-signal cartridges dropped automatically from a captive radio-sound balloon. (J.E.D.)

22696 UCRL-Trans-489

DEPENDENCE OF THE FLUORESCENCE YIELD OF IODINE VAPOR ON THE WAVELENGTH OF THE EXCITING LIGHT. M. Alentsev. Translated for Univ. of Calif., Lawrence Radiation Lab. from Doklady Akad. Nauk S.S.S.R. 62, 607-9(1948). 5p. $1.80(ph), $1.80 (mf) JCL or LC.

The fluorescence of iodine in exciting light was investigated. The exciting band width was about 30 mμ at a wavelength of 500 mμ for some experiments, and 45 mμ at 600 mμ in others. Resulting data are discussed and presented graphically. (J.R.D.)

22697

MELTING PROPERTIES OF He^3 AND He^4 UP TO 3500 kg/cm^2. E. R. Grilly and R. L. Mills (Los Alamos Scientific Lab., N. Mex.). Ann. Phys. (N. Y.) 8, 1-23 (1959) Sept.

For He^3 and He^4 the volume change on melting ΔV_m, the molar volume of fluid, V_f, and the fluid thermal expansion coefficient, were measured along the melting curve from 1.3 to 31°K at pressures up to 3500 kg/cm^2. Detailed studies of all the melting parameters were made at pressures below 250 kg/cm^2 for both isotopes. Two solid forms of He^3 were found with a transition line which intersects the melting curve at 3.15°K and 141 kg/cm^2. For He^4 an indirect determination was made of the intersection of the lambda line with the melting curve. (auth)

22698

ELECTRON INTERACTIONS. PART II. PROPERTIES OF A DENSE ELECTRON GAS. D. F. DuBois (California Inst. of Tech., Pasadena). Ann. Phys. (N. Y.) 8, 24-77(1959) Sept.

Detailed calculations were made of the effects of the interaction on the properties of an electron gas. The lowest order exchange correction to the plasmon energy is computed and found to be small in all cases of physical interest. However, the lowest order contributions to the plasmon damping are seen to modify the observed cutoff for plasmon excitation in electron energy loss experiments in a not negligible way. In applying the formalism to such experiments, the stopping power of an electron gas is discussed and the exact lowest order contribution to the single particle damping rate is derived. Using the self-energy method, the correction to the low temperature specific heat of an electron gas is computed exactly to one higher order in r_s (the interelectron spacing) beyond the calculation of Gell-Mann. It appears that the series in orders of r_s converges reasonably well only for $r_s < 2$. For $r_s < 0.8$ the specific heat is reduced from the value for noninteracting electrons while for $r_s > 0.8$ the specific heat is enhanced from this value. The change in sign appears to be a result of the Pauli Principle. From these calculations, it is concluded that the procedure of expansion in orders of r_s gives useful results for values of $r_s < 2$. For intermediate densities ($2 < r_s < 6$) the general perturbation approach may still be valid but a different approximation procedure for treating the polarization effects is needed. (auth)

22699

ANALYTICAL METHODS IN THE THEORY OF ELECTRON LATTICE INTERACTIONS. PART I. Eugene P. Gross (Brandeis Univ., Waltham, Mass.). Ann. Phys. (N. Y.) 8, 78-99(1959) Sept.

A study is made of the low-lying levels of an electron interacting with a quantized lattice vibration field. To treat the case of arbitrary coupling strength, a canonical transformation is performed. The new lattice variables describe motions carried out partly relative to the instantaneous electron position and partly about mean values depending on the average electron state. In the present initial work the wave functions are assumed to be a product of electron and lattice functions in the new variables, and are not translationally invariant. They contain functions describing the tie between particle and field and a function describing the tendency of the particle to be localized in space. The theory that results when these functions are determined in the optimum way is explored, and it is noted that the method points to a natural systematic perturbation theory. The ground state energy and effective mass of a particle is studied in detail. The approach can be directly generalized to treat more complicated hamiltonians which involve periodic potentials, magnetic fields of many electrons. (auth)

22700

THE GRAVITATIONAL ZERO MASS LIMIT OF SPIN-2 PARTICLES. O. Brulin and S. Hjalmars (Univ. of Stockholm and Royal Inst. of Tech., Stockholm). Arkiv Fysik 16, 19-32(1959).

Relativistic theory is investigated for the spin-2 particle case, where the components of the wave function of a Dirac equation are the components of a symmetric tensor of second rank and of a vector. A most general mass term, compatible with the covariance of the Dirac equation, is used to obtain the linearized Einstein equations for the gravitational field as a zero mass limit. (C.J.G.)

22701

PRECISION MEASUREMENT OF Kα X-RAY LINES FROM RARE EARTH ELEMENTS. Pär Bergvall (Inst. of Physics, Uppsala). Arkiv. Fysik 16, 57-68(1959).

Precision measurements of the $K\alpha_1$ and α_2 x-ray lines of rare earth elements are reported. The accuracy in the wavelength determination is given as 0.004 XU. Good agreement is obtained with L_{II} to L_{III} level differences obtained from L spectra. An interpolation of element 61 is given, making the list of elements 57 to 71 complete. (auth)

22702

THE USE OF THE RAD IN CLINICAL PRACTICE. C. W. Wilson (Westminster Hospital, London). Brit. J. Radiol. 32, 584-6(1959) Sept.

Problems are discussed which are involved in the adoption of the rad as the unit in terms of which absorbed radiation doses are measured and recorded. (C.H.)

22703

THE USE OF THE RAD IN CLINICAL PRACTICE. F. Ellis (Churchill Hospital, Oxford). Brit. J. Radiol. 32, 588-95(1959) Sept.

Advantages are discussed of using the rad in place of the roentgen as a radiation unit for clinical radiation practice. (C.H.)

22704

SURFACE BACK-SCATTER FOR RECTANGULAR FIELDS IN THE QUALITY RANGE FROM A HALF-VALUE LAYER OF 1 MM OF Al TO COBALT 60 GAMMA RADIATION. M. L. Emmett (Bristol Royal Hospital, Eng.). Brit. J. Radiol. 32, 615-16(1959) Sept.

A chart is presented for use in calculating the surface back-scatter for rectangular fields in the half-value range 1 to 8 mm of Al or for cobalt-60 radiation. (C.H.)

22705

MAGNETIC PROPERTIES OF CERIUM AND OF THE CERIUM–HYDROGEN SYSTEM. ELECTRIC CONDUCTIVITY OF CERIUM HYDRIDE. B. Staliński (Inst. of Tech., Wrocław, Poland and Polish Academy of Sciences, [Warsaw]). Bull. acad. polon. sci., Sér. sci., chim., géol. et géograph. 7, 269-74(1959).

The magnetic susceptibility of the cerium–hydrogen system and the electric conductivity of the hydride phase CeH_2–CeH_3 are reported. For cerium annealed for 50 hours at 300°C, the observed lattice constant value of 5.158A was determined. Magnetic investigations indicate a single f-electron of cerium does not take part in the metal-hydrogen bond. In the CeH_2–CeH_3 system no thermal hypsteresis of magnetic susceptibility was noted. (C.J.G.)

22706

THERMAL CONTACT BELOW 1°K. H. R. Hart, Jr. and J. C. Wheatley (Univ. of Illinois, Urbana). Bull. inst. intern. froid, Annexe 311-16(1958-1).

The speed of heat exchange was measured first between a quartz crystal and a single crystal of ferric ammonium alum, then between two single crystals of cerium magnesium nitrate at 0.05 to 0.3°K. The results can be represented by $Q = \alpha \times \text{surface area} \times (T^n_{hot} - T^n_{cold})$ where n = 3.7 and $\alpha = 2.5 \times 10^4$ erg/sec cm^2 (°K)$^{3.7}$ in the first experiment and n = 3.4 and $\alpha = 4.5 \times 10^3$ erg/sec cm^2 (°K)$^{3.4}$ for the second. (T.R.H.)

22707

STRAIN GAGE MEASUREMENTS UNDER WATER IN THE INTERIOR OF A PRESSURE CONTAINER. Gh. Buzdugan, A. Petre, and M. Blumenfeld (Institut Polytechnique, Bucharest). Bul. inst. politehnic Bucuresti 20, No. 1, 195-204(1958) Jan.-Mar. (In French)

To obtain strain gage measurements under water it was necessary to solve the problem of insulating the transducers against water as well as to fasten and insulate the electric wires at the container exit. This was accomplished by using a protective box for the transducers, filled with transformer oil and connected to the water. The conductor exit led through an pertinax-insulated steel plate. The complete measuring and operation technique is described. (auth)

22708

DETERMINATION OF THE CHANGES IN THE LATTICE PARAMETER OF VARIOUS GRAPHITES. Ferdinand M. Kissler. Chem. Listy 51, No. 1, 13-20(1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 15552.)

A description is given of a new method for determining the lattice parameters of graphite, using an asymmetrical base for the photographic film and radiation with a relatively large wave length. It is indicated that the method of backward reflection does not justify itself in the study of graphite. The accuracy of determining the interplanar distances by the proposed method is ±0.003 A. The method gives very exact results in the study of the changes of the interplanar distances of carbons in graphitization and in the detection of the rhombohedric structure of graphite.

22709

MEASUREMENT OF THE EXTRACTION VELOCITY OF S^{35} PRODUCED IN CsCl BY NEUTRON IRRADIATION. APPLICATION TO THE STUDY OF THE ALLOTROPIC TRANSFORMATION OF CsCl. Frederic Lantelme and Jules Pauly (College de France, Paris). Compt. rend. 249, 677-9(1959) Aug. 3. (In French)

Cesium chloride crystals are irradiated with neutrons, and the S^{35} produced is separated by heating in a current of hydrogen. The extraction velocity is followed as a function of temperature. The allotropic transformation of CsCl was observed at 480°C. (tr-auth)

22710

ELASTIC FORWARD SCATTERING OF PHOTONS BY BOUND ELECTRONS. C. Eftimiu. Comun. acad. rep. populare Romîne 8, 153-8(1958). (Translated from Referat. Zhur. Fiz. No. 1, 1959, Abstract No. 293).

The effective cross section for forward scattering of photons by bound electrons is calculated with the aid of the dispersion relation, $\text{Re } a(w,o) = \frac{w}{\pi} P\int_{-\infty}^{+\infty} \frac{\text{Im } a(w',o)dw'}{w'(w'-w)}$

22711

AUTOMODEL MOTIONS AND POINT EXPLOSION IN MAGNETIC GAS DYNAMICS FOR A GAS OF INFINITE CONDUCTIVITY. D. V. Sharikadze (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 127, 1183-6(1959) Aug. (In Russian)

Automodel motions and point explosions in gases of infinite conductivity are investigated by expressing the magnetic field intensity as a power function of entropy. (R.V.J.)

22712

THE FLUX AND SPECTRUM OF COSMIC-RAY PRODUCED NEUTRONS AS A FUNCTION OF ALTITUDE. H. W. Patterson, W. N. Hess, B. J. Moyer, and R. W. Wallace (Univ. of California, Berkeley). Health Phys. 2, 69-72(1959) July.

A series of measurements of neutron flux as a function of altitude has been made with the following neutron detectors: bismuth fission ionization chamber, proton-recoil proportional counter, and moderated and bare BF_3 proportional counters. In addition, data were also taken with a Simpson pile. Altitudes ranged from sea-level to 40,000 ft and latitudes from 28° to 49°N. Appropriate treatment of the data can be made to yield information about the neutron spectrum and the average neutron energy, and consequently about the dose rate. (auth)

22713

CALCULATIONS OF ENERGY LOSS UNDER THE BIAS IN FAST NEUTRON DOSIMETRY. R. H. Ritchie (Oak Ridge National Lab., Tenn.). Health Phys. 2, 73-6(1959) July.

The amount of energy loss under the bias in an integrating fast neutron dosimeter is treated by considering

an idealized model of a dosimeter which has been considered previously by Petrov. It is shown that when one includes that portion of the energy deposited in the chamber which is recorded by an integrating circuit, one finds much smaller losses than are found by Petrov. (auth)

22714

INTEGRAL-PHOSPOR COUNTING OF α-EMITTERS. D. A. Morken (Univ. of Rochester, N. Y.). Health Phys. 2, 77-8(1959) July.

Silver-activated zinc sulfide powder has been reported to remove polonium and the decay products of radon from solution, and has been found to remove plutonium and uranium from solution. The zinc sulfide powder, which settles out of solution, is a radioactive phosphor, the scintillations from which may be detected with a bare multiplier phototube and counted by the usual methods. Additional amplification of the electrical signal is unnecessary. Results are presented from a preliminary study of the possibilities of applications in the quantitative assay of alpha emitters. It was concluded that the method holds promise for situations in which only one isotope is present, or if total alpha activity only is desired. (C.H.)

22715

FINE STRUCTURE OF X-RAY ABSORPTION K SPECTRA OF TITANIUM IN HYDRIDES, BORIDES, AND SILICIDES. E. E. Vaĭnshteĭn and E. A. Zhuravskii (Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences USSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 8, 1493-5(1959) Aug. (In Russian)

X-ray spectral analyses confirmed the hypothesis on the metal-like state of hydrogen in titanium hydrides. Experiments with titanium borides and silicides indicate the special character and degree of the 3d-level participation in the "metallic" bond between the atoms of various complexes. The structure of metalloid elements becomes more complicated with an increase in the specific number of boron and silicon atoms and the bond between the atoms tends to become covalent. (R.V.J.)

22716

ON THE PROBLEM OF X-RAY INFLUENCE ON ELECTRIC CONDUCTANCE. A. D. Shchelokov. Izvest. Tomsk. Politekh. Inst. im. S. M. Kirova, No. 91, 391-8 (1956). (Translated from Referat. Zhur. Elektrotekh. No. 2, 1958, p.12).

Electric conductance of natural NaCl single crystals was studied under the influence of x rays of various intensities and at various temperatures. In nonirradiated specimens, the electric conductance is due to ions, and the effect of temperature on conductance obeys an exponential law. Under irradiation conditions, an electronic component of conductance is added, this component being larger with lower temperature and higher intensity of irradiation. As the ionic current grows very quickly with temperature increase, while the electron current grows slowly, no effect of x ray on electric conductance of a NaCl crystal has been observed at high temperatures.

22717

ON THE INITIAL STAGES OF DEVELOPMENT OF A HIGH-FREQUENCY DISCHARGE FROM A POINT IN AIR AT ATMOSPHERIC PRESSURE. O. F. Kabardin. Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz., No. 6, 51-6 (1958).

An investigation of the conditions for development of a high-frequency discharge from a point is reported. The method of simultaneous application of a constant (direct) and a high-frequency field was used. The apparatus employed consisted of a high-frequency oscillator, a high-voltage rectifier, and a discharge gap. It was found that the voltages at which the discharge started lie below the voltages at which positive and negative d-c corona pulses were first observed. The voltages at which the discharge first occurs depends only slightly on the form and dimensions of the pointed electrode or on the configuration of the discharge gap, but they fall rapidly with frequency. The results obtained when a high-frequency voltage was applied simultaneously with a d-c voltage are shown for the electrode whose pointed end was 1.0 mm in diameter. The high-frequency discharge may be started by the initial processes occurring either in a positive or a negative corona. When a high-frequency field is applied by itself the initial stages of the discharge are similar to those occurring on superposition of a d-c and a high-frequency voltage. At frequencies up to 5 Mc/s the high-frequency discharge is started by positive corona pulses, and above 5 Mc/s it is started by negative corona pulses. These pulses are due to accumulation of gaseous ions at the pointed ends of the platinum electrodes. (TCO)

22718

EFFECTIVE ELECTRICAL CONDUCTIVITY OF CONTINUOUS MEDIA AT HIGH FREQUENCIES AND ITS CONNECTION WITH LONGITUDINAL OSCILLATIONS OF PLASMA. R. M. Kessenikh. Izvest. Vysshikh Ucheb. Zavedeniĭ, Fiz., No. 6, 85-90(1958).

An expression for effective electric conductivity (σ_{eff}) is derived. For practical computation σ_{eff} is more conveniently expressed as $\sigma = \frac{\epsilon''}{60\lambda}$ where λ is the wavelength in meters associated with the angular frequency ω. Values of σ_{eff} are tabulated for some typical dielectrics (ceramic VK-92, polyethylene, and polystyrene) for wavelengths in the 15 to 46 m region. In each case σ_{eff} exceeds the corresponding d-c conductivity by a factor of about 10^8. Graphs are also presented showing the variation of σ_{eff} with frequency. Finally the relation of this theory with the theory of longitudinal plasma oscillations is briefly discussed. The equations for energy dissipation as a function of frequency are similar in the two cases and it is suggested that the behavior of an oscillating plasma might be discussed by replacing it by a mathematically equivalent dielectric. The analogy is not pursued in detail. (TCO)

22719

MICROWAVE CONDUCTIVITY OF SLIGHTLY IONIZED AIR. Henry Margenau and Dorothea Stillinger (Yale Univ., New Haven). J. Appl. Phys. 30, 1385-7(1959) Sept.

The conductivity of air ionized by injection of electrons at different altitudes is computed with the use of experimentally established collision cross sections of electrons in oxygen and nitrogen. The results, in the form of graphs, are compared with the usual, simpler formulas based upon the assumptions of a constant collision frequency and a constant mean free path. The departures are in excess of the experimental error in good conductivity measurements. (auth)

22720

PULSE TECHNIQUE FOR PROBE MEASUREMENTS IN GAS DISCHARGES. John F. Waymouth (Sylvania Elec-

tric Products, Inc., Salem, Mass.). J. Appl. Phys. 30, 1404-12(1959) Sept.

A pulse technique for making Langmuir probe measurements in gas discharges was developed. The basic procedure consists in operating the probe 40 to 50 v negative with respect to the discharge, and pulsing it positive at a repetition rate of 60 cps. The probe current-voltage characteristic during the positive-going pulse is presented on an oscilloscope and the resulting trace is photographed. The phase of the pulse may be varied, so that the method is useful for studying 60 cps ac discharges as well as dc discharges. Positive-ion bombardment while the probe is strongly negative tends to sputter away contamination and makes it possible to keep the probe clean while making measurements within one mm of an oxide cathode at 1000°C, despite rapid evolution of contaminants from the cathode. Together with the small size of the probes that can be used, this permits meaningful measurements to be made in the negative glow of an oxide-cathode low-pressure discharge of the fluorescent-lamp type. Measurements on such lamps are described which demonstrate the presence of energetic primary electrons from the cathode as well as secondary electrons in the negative glow. (auth)

22721

NUCLEAR MAGNETIC RESONANCE STUDIES OF DISLOCATIONS IN NaI AND KI. J. F. Hon and P. J. Bray (Brown Univ., Providence). J. Appl. Phys. 30, 1425-8 (1959) Sept.

Intensity anomalies were found in the nuclear magnetic resonance of I^{127} in NaI and KI single crystals when the magnetic field is along a [1,0,0] type direction. The intensity enhancement in these cases indicates a collapse of the satellite transitions ($m \rightarrow m-1$, $m \neq \frac{1}{2}$) into the central transition ($m = \frac{1}{2} \rightarrow m = -\frac{1}{2}$). It is concluded that the crystals contain edge and/or screw dislocations which are preferentially oriented along [1,1,0] and [1,0,0] type directions, respectively. The degree of orientation is greater in NaI than in KI. These studies afford an explanation of anomalous resonance line widths reported for NaI by other observers. (auth)

22722

NEW METHOD FOR RANGE MEASUREMENTS OF LOW-ENERGY ELECTRONS IN SOLIDS. J. E. Holliday and E. J. Sternglass (Westinghouse Research Labs., Pittsburgh). J. Appl. Phys. 30, 1428-31(1959) Sept.

A method for determining the range of low-energy electrons in solids is described and compared with older techniques. In the method, the material under study is deposited on a thick layer of greatly different electron backscattering characteristics. When the incident electrons have just sufficient energy to penetrate to the support and return to the surface, a marked change in the backscattered fraction occurs. In this manner, the need for very thin organic supporting films of unknown stopping power is avoided. Range-energy data from 1 to 15 kev for films of aluminum on a gold substrate obtained by this technique are found to agree with the data obtained by the use of cathode luminescence to detect electron penetration. The technique was applied to thin films of gold in the energy region from 2 to 15 kev. It was found that the practical ranges in mg/cm^2 for gold and aluminum were the same below 10 kev, unlike the situation in the mev region where the effective penetration into Al is about twice that for Au due to the importance of nuclear scattering in a high Z element. Good agreement is found with the Bohr-Bethe theory for aluminum at all energies and for Au below ~10 kev. (auth)

22723

EFFECT OF PRESSURE ON THE SPECTRA OF OLIVINE AND GARNET. A. S. Balchan and H. G. Drickamer (Univ. of Illinois, Urbana). J. Appl. Phys. 30, 1446-7(1959) Sept.

The effect of pressure was measured on the absorption edge of olivine and on the Fe^{2+} peak of garnet to over 150,000 atmos. The absorption edge of olivine shifts red by about 9% of the gap in this pressure range. The Fe^{2+} peak in garnet shifts to higher energies by 700 cm^{-1} in 170,000 atmos, due to increased splitting of the d levels by the ligand field. This is consistent with previous experimental work on transition metals, and with available theory. The temperature coefficient of the absorption edge of olivine was also measured at atmospheric pressure to 327°C. It exhibited a linear red shift of 4.21×10^{-4} ev/°C over this range. (auth)

22724

SIMPLE SEMIEMPIRICAL MODEL FOR NEUTRON INDUCED STORED ENERGY IN GRAPHITE. John J. Newgard (Thiokol Chemical Corp., Denville, N. J.). J. Appl. Phys. 30, 1449-51(1959) Sept.

A simple model is introduced to explain the saturation effect observed in the stored energy vs. neutron dose in graphite. An expression capable of correlating the empirical data over the entire range is given. (C.J.G.)

22725

VACILLATING WAVE RESULTS FROM ELECTRIC FIELD AND POWDER FILLED DIELECTRIC. John M. Lohse and Milton R. Zimmerman (Sandia Corp., Albuquerque, N. Mex.). J. Appl. Phys. 30, 1464-5(1959) Sept.

In studying the movements of particles suspended in dielectrics in an electric field under a microscope, an experiment involving addition of fine iron powder (7 to 70 μ) displayed the phenomena of a vacillating surface wave. The surface wave was observed to sweep between electrodes at a time interval of 6.1 sec. No explanation is offered on the surface wave. (C.J.G.)

22726

DIRECT APPROACH TO QUANTITATIVE AUTORADIOGRAPHY. R. K. Poddar (Univ. of California, Berkeley). J. Appl. Phys. 30, 1539-41(1959) Oct.

Several physical factors which influence an autoradiographic image produced by radioactive inclusions in thin experimental specimens were correlated through a semiempirical formula. The latter may be used to estimate the concentration of a radioisotope in a specimen from microscopic measurement of grain density in its autoradiograph, if the period of exposure, sensitivity of the photographic emulsion, and the actual geometrical arrangements of the experiment are known. (auth)

22727

CHARACTERISTICS OF UC, ZrC, AND (ZrC) (UC) AS THERMIONIC EMITTERS. R. W. Pidd (Univ. of Michigan, Ann Arbor) and G. M. Grover, D. H. Roehling, E. W. Salmi, J. D. Farr, N. H. Krikorian, and W. G. Witteman (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 30, 1575-8(1959) Oct.

Uranium carbide is found to have the property of high thermionic emission in the observed temperature range from 1400 to 1800°K. The parameters of the Richardson equation which can be used to fit the data are A = 7.3 ×

10^6 amp/cm^2 (°K)^2 and ϕ = 4.57 v. While these parameters accurately predict the observed saturated currents, it is doubtful that such anomalous values are of theoretical significance within the framework of the Richardson-Dushman derivation. A solid solution form of uranium carbide and zirconium carbide gives substantially the same thermionic emission as uranium carbide, and for other reasons appears to be the more useful emitter. The carbides require no surface preparation or activation schedule for use as emitters. (auth)

22728

EXPERIMENTAL DETERMINATION OF ATOMIC SCATTERING FACTORS. R. B. Roof, Jr. (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 30, 1599-1603 (1959) Oct.

The atomic scattering factor for aluminum was experimentally re-examined. First-order corrections for the effect of temperature, surface roughness, primary extinction, secondary extinction, and anomalous dispersion were applied to experimental absolute intensity measurements made on a powder slab of aluminum. The average deviation between the experimentally determined and the theoretical atomic scattering factor for aluminum is 0.16 electron. The slightly different shape of the experimental curve, as compared to the theoretical curve, is interpreted as evidence for a greater contraction in the 3p shell of aluminum than had been heretofore assumed. (auth)

22729

HARMONIC GENERATION IN A CYCLOTRON RESONANT PLASMA. R. M. Hill and S. J. Tetenbaum (Sylvania Microwave Physics Lab., Mountain View, Calif.). J. Appl. Phys. 30, 1610-11(1959) Oct.

Plasma was contained in a rectangular quartz bottle under helium at a pressure in the range from several microns to 1.2 mm of Hg. Second, third, fourth, and fifth harmonics of the fundamental were observed. The maximum conversion efficiencies are listed for a peak power of 300 w at a fundamental frequency of 2960 Mc. (C.J.G.)

22730

ELASTIC SCATTERING OF SLOW IONS IN GASES. Edward A. Mason and Joseph T. Vnaderslice (Univ. of Maryland, College Park). J. Chem. Phys. 31, 594-600 (1959) Sept.

Differential cross sections for the elastic scattering of slow ions by neutral atoms or molecules were calculated by numerical integration of the classical equations of motion. The model used for the ion-neutral potential energy function consists of three terms: an r^{-4} attraction, an r^{-6} attraction, and an r^{-12} repulsion. The attractive terms are theoretically sound, but the repulsive term is empirical. Quantum effects were ignored, but an approximate formula indicates at what point the classical calculations begin to fail in any particular case. The results should be of most use in the very low energy region where experimentation is difficult. (auth)

22731

ABSORPTION SPECTRUM OF $NiCl_2$ IN MOLTEN LiCl/KCl. Benson R. Sundheim and George Harrington (New York Univ., New York). J. Chem. Phys. 31, 700-1 (1959) Sept.

The absorption maxima in the spectra of $NiCl_2$ in molten LiCl/KCl are discussed from the point of view of the ligand field theory. It is concluded that the nickel ion is surrounded by four chloride ions in a nearly tetrahedral arrangement. Variations in the intensity of one of the bands give a sensitive indication of the degree of distortion of this structure. (auth)

22732

VARIATION OF APPEARANCE POTENTIALS OF ALKANE FRAGMENT IONS WITH THE REPELLER VOLTAGE OF THE MASS SPECTROMETER ION SOURCE. L. Friedman, F. A. Long, and M. Wolfsberg (Brookhaven National Lab., Upton, N. Y. and Cornell Univ., Ithaca, N. Y.). J. Chem. Phys. 31, 755-8(1959) Sept.

The differences in the mass spectrometric appearance potentials for parent molecule ions and the ion fragments which are formed from the parent by hydrogen abstraction were measured for propane, n-butane, and n-pentane as a function of the repeller voltage in the ion source. With pentane, the potential difference varies from close to zero for no repeller voltage to 1.1 volts for 0.5 volt repeller voltage or higher. There is a similar but smaller increase of 0.6 volt with n-butane, while with propane the changes in appearance potentials are well within the experimental error. Of the various explanations considered, the most likely is that zero repeller voltage leads to relatively longer ion residence times in the source and that, as a result, some low-probability de-excitation processes have time to occur. This implies that appearance potentials which are obtained for this type of process with use of the usual repeller voltages can be considerably in excess of the minimum threshold energies. (auth)

22733

STATISTICAL INTERPRETATION FOR ABNORMAL ROTATION OF OH* SPLIT FROM H_2O_2 BY ELECTRON IMPACT. T. Horie (Osaka Univ.) and S. Watanabe and K. Kurata (Prefectural Univ. of Mie, Tsu, Japan). J. Chem. Phys. 31, 783-7(1959) Sept.

The angular momentum distribution of OH* split from H_2O_2 by electron impact or ultraviolet irradiation is quite abnormal in appearance. A statistical interpretation is presented of the relative population of the excited rotational levels of OH* in the dissociation process of H_2O_2 into two hydroxyl radicals. The phase volume is calculated under the constraints of the conservation of energy, momentum, and angular momentum by the method using delta and step functions. A discrepancy which takes place beyond K = 24 between the calculated curve and the observational plots is attributed to the predissociation of OH*. (auth)

22734

ELECTRON IMPACT STUDY OF NITRIC OXIDE USING A MODIFIED RETARDING POTENTIAL DIFFERENCE METHOD. G. G. Cloutier and H. I. Schiff (McGill Univ., Montreal). J. Chem. Phys. 31, 793-9 (1959) Sept.

An electron impact study of NO was made using the retarding potential difference method for producing the effect of a monoenergetic electron beam. In this modification of the method the electron retarding potential is provided by the potential minimum which exists between the anode and cathode of a space-charge limited diode. The ionization potential of NO was found to be 9.25 ± 0.02 ev and the ionization efficiency curve for NO^+ to be nonlinear near the onset. This curvature can be attributed to the difference in the equilibrium internuclear distances of NO and NO^+. Appearance potentials were obtained for the formation of N^+, O^+, and O^- ions from a number of processes. With the exception of O^- ions formed by electron capture, it was not necessary to postulate that any of the ions are formed with excess

kinetic energy. The appearance potentials of all the processes are consistent, within experimental error, with a value of 6.50 ev for the dissociation energy of NO. The shape of the resonance capture curve for O^- formation was used to construct part of the potential energy diagram for the NO^- ion. (auth)

22735

RESONANCE RADIATION BEHIND SHOCK WAVES IN Xe. Walter Roth (General Electric Research Lab., Schenectady, N. Y.). J. Chem. Phys. 31, 844-5(1959) Sept.

The relative temporal behavior of resonance line emission and visible continuum emission behind incident shock waves in xenon are investigated. (C.J.G.)

22736

SINGLE CRYSTAL ELECTRON SPIN RESONANCE SPECTRA FOR x-IRRADIATED GLYCINE. J. J. Windle (Western Regional Research Lab., Albany, Calif.). J. Chem. Phys. 31, 859-60(1959) Sept.

Electron spin resonance spectra are reported for x-irradiated single crystals of glycine for various orientations of the crystalline axes with respect to the applied magnetic field. (C.J.G.)

22737

MEASUREMENT OF PLASMA TEMPERATURE AND ELECTRON DENSITY. Kiyoshi Murakawa and Shizuyo Mizuno-Hashimoto (Univ. of Tokyo). J. Phys. Soc. Japan 14, 1235-42(1959) Sept.

The temperature of the plasma obtained by passing condensed discharge through a Geisler tube containing neon was measured. The wave-length of Ne I λ5852 emitted from condensed discharge was compared with that of the same line emitted from arc discharge, the comparison being made with a Fabry-Perot etalon. Red shift of the line by spark discharge was detected. From the amount of the shift the half-value width contributed by the ionic field and electrons was calculated by Lindholm's formula. Subtracting this (vectorially) from the observed half-value width, the width contributed by the Doppler effect alone was obtained, and then the plasma temperature was calculated. From the line profiles of Hγ and Ne I λ4715 Holtsmark's so-called normal field strength F_n was obtained, and therefore the electron density could be deduced. In our present example the mean plasma temperature was $T = 6 \times 10^3$ K, and the mean electron density $N = 1 \times 10^{16}$ per cm^3. (auth)

22738

THE MECHANICAL RESISTANCE OF D_2O SINGLE CRYSTALS. S. Woerner and S. Magun (Technische Hochschule, Stuttgart). Naturwissenschaften 46, 509-10(1959). (In German)

The mechanical resistance of D_2O crystals, approximately 12 cm long and 1.5 cm in diameter, was measured at frequencies from 0.2 to 4 kHz and at temperatures from −90 to +2°C. The results showed that the resistance of D_2O crystals has the same dependence on temperature and frequency, oscillation type, and crystallographic orientation as light ice. The activation energy, determined from the temperature dependence of the resistance maxima, has the same value as that of H_2O crystals. The frequency displacement was calculated. (J.S.R.)

22739

MICROWAVE DIAGNOSTICS IN PLASMA RESEARCH. S. M. Hamberger (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Power 4, No. 41, 106-7(1959) Sept.

The use of microwaves for studying the properties of plasma in thermonuclear experiments is reported. Diagrams are given for the systems used in plasma density, velocity, and temperature measurements. (C.J.G.)

22740

ABSORPTION OF MONOENERGETIC X- AND γ-RAYS. Marvin H. Green (Dept. of Public Health, Philadelphia). Nucleonics 17, No. 10, 77(1959) Oct.

A nomograph is presented for application to radioactive decay and reactor neutron-flux change as a function of reactor period. (C.J.G.)

22741

FUSION ONE YEAR AFTER GENEVA. Stirling A. Colgate (Lawrence Radiation Lab., Univ. of California, Livermore). Nucleonics 17, No. 10, 82-4(1959) Oct.

A discussion is given on the papers presented at the 1959 Uppsala Conference on Ionization Phenomena in Gases. Emphasis is placed on theta pinches and mechanisms. Some future work to be undertaken is reported. (C.J.G.)

22742

A SIMPLE METHOD FOR THE DERIVATION OF WIEN'S LAW OF RADIATION. C. L. Wang. Pei Ching Ta Hsüeh Hsüeh Pao—Tza Jan K'o Hsüeh No. 1, 75-80(1958). (From Sci. Abstr. China; Mathematical and Phys. Sci. No. 2, 1958, Abstract No. 129.)

According to Jean's theory, the heat radiation of a blackbody at a certain temperature in thermal equilibrium may be studied as an infinite number of harmonic oscillators inside a resonating cavity. The number of modes of vibration for those electromagnetic waves having the wave length greater than a certain value λ was found to be $N = 8\pi V/3\lambda^3$, where V is the volume of the cavity. On the basis of this idea and from thermodynamical reasoning, a more direct and comparatively simpler method is introduced for the derivation of Wien's law of radiation. It is to be noted that such a method also calls for the necessity of introducing Planck's idea of energy quanta. (auth)

22743

REMARKS ON THE MULTIPLE SCATTERING THEORY IN NUCLEI. Li-ming Yang. Pei Ching Ta Hsüeh Hsüeh Pao—Tza Jan K'o Hsüeh 4, 277-86(1958). (From Sci. Abstr. China; Mathematical and Phys. Sci. No. 2, 1958, Abstract No. 126.)

A systematic formulation is presented of the multiple scattering theory in nuclei. The theory of Watson is placed on a broader basis to find higher order approximations. The method starts with suitable partition and grouping of single scattering events. To a good approximation, it is shown that the multiple scattering which a single incident nucleon undergoes in a nucleus may be analyzed successively into elastic and inelastic parts, exchange scattering being neglected here. The elastic part of scattering and therefore the optical model potential is contributed from elastic as well as inelastic single scatterings. (auth)

22744

ELECTRON BOMBARDMENT OF SILICON. D. E. Hill (Purdue Univ., Lafayette, Ind.). Phys. Rev. 114, 1414-20(1959) June 15.

The electrical properties of single crystal silicon

were investigated as a function of bombardment with high-energy electrons. Measurements of the initial carrier removal rate were carried out at 273°K for samples with widely different carrier concentrations. A second type of experiment involved the measurement of the temperature dependence of resistivity and Hall coefficient at different stages of the bombardment. Bombardment-produced energy levels were found at 0.03, 0.17, and 0.4 ev below the edge of the conduction band. With 4.5-Mev electrons, the introduction rates for these levels were 11, 0.5, and 0.05 cm^{-1}, respectively. Bombardment levels were also found at 0.05 and 0.3 ev above the edge of the valence band. With 4.5-Mev electrons the introduction rates for these levels were 13 cm^{-1} and roughly 0.3 cm^{-1}, respectively. Irradiations with 700-kev electrons indicate the presence of the same defect levels with correspondingly smaller introduction rates. An investigation of the irradiation-induced mobility changes for degenerate p-type silicon indicates that, for each hole removed from the valence band, there appears a singly-charged scattering center. For near-degenerate n-type samples, the mobility changes are much smaller. Results of bombardments at 78 and 10°K show that the net damage rate decreases by a factor of 2 or more when bombardments are carried out at lower temperatures. (auth)

22745

RECOVERY OF ELECTRON-IRRADIATED COPPER. I. CLOSE PAIR RECOVERY. J. W. Corbett, R. B. Smith, and R. M. Walker (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 114, 1452-9 (1959) June 15.

Stage I recovery (14 to 65°K) of electron-irradiated, high-purity copper is shown to be composed of at least five substages: I_A, 14 to 24°K; I_B, 24 to 28.5°K; I_C, 28.5 to 33°K; I_D, 33 to 48°K and I_E, 48 to 65°K. I_A, I_B, and I_C recovery are discussed in further detail. I_B and I_C are shown to have the characteristics of close-pair recovery. It is inferred that I_A also has these characteristics. The values of the activation energy for recovery are $E_A = 0.05 \pm 0.01$ ev, $E_B = 0.085 \pm 0.01$ ev, and $E_C = 0.095 \pm 0.01$ ev. An attempt to relate the observed close-pair spectrum to specific interstitial-vacancy configurations is described. (auth)

22746

RECOVERY OF ELECTRON-IRRADIATED COPPER. II. INTERSTITIAL MIGRATION. J. W. Corbett and R. M. Walker (General Electric Research Lab., Schenectady, N. Y.) and R. B. Smith (General Electric Co., Richland, Wash.). Phys. Rev. 114, 1460-72(1959) June 15.

Several experiments are presented dealing with substages I_D (33 to 48°K) and I_E (48 to 65°K) of Stage I (14°K–65°K) recovery in electron-irradiated pure copper. It is concluded that both I_D and I_E represent the recovery due to the free diffusion of a defect, presumably an interstitial atom, with an activation energy for motion $E_m = 0.12 \pm 0.005$ ev. I_D is the result of correlated recovery (the interstitial returns to the vacancy from which it came) while I_E is the result of uncorrelated recovery (the interstitial travels to a distant sink). The migrating interstitial is shown to interact with vacancies, traps, and other interstitials leading respectively to annihilation, trapping, and cluster formation. The interaction between two interstitials leading to cluster formation is found to be comparable with the annihilation interaction between an interstitial and a vacancy. Clusters containing more than two interstitials are also formed. Previous work in copper is discussed, and it is concluded that this previous work is consistent with the above description of Stage I recovery. The relationship of the present work to the general problem of assigning defect processes to the higher temperature recovery states in copper is also discussed. (auth)

22747

PRESSURE EFFECTS IN LUMINESCENCE: ISOBARIC EXPERIMENTS ON NaI(Tl). L. Reiffel (Armour Research Foundation, Chicago). Phys. Rev. 114, 1493-9 (1959) June 15.

The effect of steady-state hydrostatic pressure on the properties of luminescent systems, with particular reference to the phosphorescence of NaI(Tl), is examined. It is shown that readily observable changes in decay mean life may be produced by very modest pressures. An interpretation of this effect is developed from a configurational coordinate model and also from thermodynamic considerations. Experimental results are in good agreement with these theoretical expectations. For a 0.66-ev trap in NaI(Tl), the change in center volume at the point of transition from metastable to emitting state is found to be $+17.5 \times 10^{-24}$ cm^3. Assuming a specific model for the center allows computation of the sign and magnitude of the critical displacement of ions required for trap collapse—in this case +0.19 A. The force constant for the metastable state is computed to be 5.8×10^5 dynes/cm; and the vibrational frequency, assuming an effective mass equal to six I^- ions, is 3.4×10^{12} sec^{-1} corresponding to a zero point energy for this trap of 0.007 ev and cross over at a vibrational quantum number of about 47. The transmission coefficient for cross-over to the emitting state appears to be of the order of 0.03%. Other possible experiments involving steady-state or transient pressure effects are outlined. (auth)

22748

SCATTERING OF ELECTRONS WITH AN INTRINSIC ELECTRIC DIPOLE MOMENT. B. Margolis, S. Rosendorff, and A. Sirlin (Columbia Univ., New York). Phys. Rev. 114, 1530-3(1959) June 15.

The elastic scattering of electrons with a small intrinsic electric dipole moment (e.d.m.) by spinless targets is discussed in the first and second Born approximations. For large momentum transfer ($q \sim 500$ Mev/c) the e.d.m. contribution to the elastic scattering cross section becomes important even for values $\lambda \sim 10^{-3}$ (where λ is the e.d.m. in units of e times the Compton wave length of the electron). Thus, it seems likely that experiments involving high-energy electrons may give valuable information on the hypothetical existence and upper limit of the e.d.m. interaction. It is found, in the first Born approximation, that at sufficiently high energies the existence of the e.d.m. can change the polarization of the electron beam from longitudinal to transverse. Finally, asymmetry effects which appear in the second Born approximation are discussed in detail. Detection of these asymmetries or of the spin correlation effects of the first Born approximation mentioned above would imply the noninvariance of the electromagnetic interactions under parity and time reversal. (auth)

22749

IONIZATION PRODUCED BY ATOMIC COLLISIONS AT kev ENERGIES. II. A. Russek and M. Tom Thomas

(Univ. of Connecticut, Storrs). Phys. Rev. 114, 1538-40(1959) June 15.

The electron evaporation model of the collision-ionization process that occurs when atoms collide at high energies is extended and improved. An alternate model of the process is considered. This alternate model treats the collision-ionization process as being due to direct knock-outs of the electrons by violent electron-electron collisions. It is found that this model cannot be made to account for the data, thereby lending additional support to the assumptions inherent in the evaporation model. (auth)

22750

THRESHOLD PROPERTIES OF SCATTERING AND REACTION CROSS SECTIONS. Roger G. Newton (Indiana Univ., Bloomington). Phys. Rev. 114, 1611-18 (1959) June 15.

The detailed behavior of elastic and inelastic scattering cross sections as functions of the energy at the threshold of a new reaction is derived from general principles. The results lend themselves in certain cases to the experimental determination of spins and parities of reaction products, as well as of not directly observable scattering amplitudes and inelastic cross sections. A number of special cases are treated in detail. (auth)

22751

ENERGY DEPENDENCE OF RECOVERY IN IRRADIATED COPPER. J. W. Corbett and R. M. Walker (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 115, 67-70(1959) July 1.

Stage I recovery in electron-irradiated copper consists of five substages of recovery, designated as I_A(14 to 24°K), I_B(24 to 28.5°K), I_C(28.5 to 33°K), I_D(33 to 48°K), and I_E(48 to 65°K), in order of increasing temperature. The shift in the populations of I_A to I_E is reported as a function of the energy of the bombarding electrons. The sum of the first three substages (I_A, I_B, and I_C) increases with decreasing bombarding energy at the expense of the higher temperature sub-stages. The ratio I_D/I_E also increases with decreasing energy. The data are interpreted as corroboration of a previously proposed model for stage I recovery. The measured shifts are quite small. This is discussed in relation to the recoil energy distributions and it is concluded that the most likely interpretation is that the average separation between a primary recoil and its vacancy does not vary rapidly with increasing recoil energy near threshold. Several possible explanations for this behavior are outlined. (auth)

22752

ELECTROMAGNETIC PROPERTIES OF SUPERCONDUCTORS. K. K. Gupta and V. S. Mathur (Univ. of Chicago). Phys. Rev. 115, 75-8(1959) July 1.

An integral relationship between the super-current and the vector potential of the electromagnetic field, similar to Pippard's phenomenological equation, is derived from the gauge-invariant theory of Wentzel. Expressions for coherence distance and penetration depth are calculated. (auth)

22753

ABSORPTION BY GASEOUS HELIUM IN THE EXTREME ULTRAVIOLET. Norman N. Axelrod and M. Parker Givens (Univ. of Rochester, N. Y.). Phys. Rev. 115, 97(1959) July 1.

The absorption by gaseous helium at room temperature has been studied in the spectral region 550 A to 150 A. The measurements of Lee and Weissler were confirmed and extended. The data are in substantial agreement with the theoretical predictions of Huang. (auth)

22754

FERMI ACCELERATION OF ELECTRONS IN THE OUTER VAN ALLEN BELT. J. A. Crawford (Univ. of California, Berkeley). Phys. Rev. Letters 3, 316-18 (1959) Oct. 1.

It can be shown that a large solar storm cloud should wipe out any radiation in the outer Van Allen belt. In order therefore to account for the presence of this intense radiation it has been suggested that it is originally trapped in the cloud and deposited in the earth's field during the geomagnetic storm. It is shown that this assumption is unnecessary since the radiation in the outer belt may be accounted for by a local Fermi acceleration created by the interaction between the storm and the geomagnetic field. (W.D.M.)

22755

A UNIFIED MODEL OF K- AND π-MESONS. T. H. R. Skyrme (Univ. of Pennsylvania; Philadelphia). Proc. Roy. Soc. (London) A252, 236-45(1959) Sept.

On the foundation of an antecedent nonlinear meson field theory it is suggested that the π-meson fields may be described in terms of collective motions of the K-meson fields. A particular model of the K-nucleon interaction is considered whose collective π-modes have symmetrical PV coupling with the nucleon system; parity is conserved to a great extent for the π-nucleon system in the absence of strange particles. The direct K-nucleon interactions do not conserve parity; their sign and symmetry are qualitatively acceptable. The masses and coupling constants of the meson fields are determinate in terms of one universal coupling constant and a cut-off. The structure of this model suggests a natural way for the introduction of the 'spurion,' describing weak interactions that violate strangeness. (auth)

22756

DYNAMICAL PROPERTIES OF s-d INTERACTION. Hiroshi Hasegawa (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 483-500(1959) Apr.

The dynamical properties of two spin systems composed of conduction electron spins and localized d-spins interacting by exchange are investigated in connection with the electron-spin resonance of d-spins with the free electron g-value. It seems that some basic considerations are necessary for the problem along the line of the widely accepted idea that the s-d interaction itself does not lead to any relaxation time and shift. The usual adiabatic approximation is applied to this idea. A modified damping equation of the Bloch type as well as Bloch's relaxation theory are also useful, but these are not enough for a complete solution of the problem. A certain controversy involved in recent experimental and theoretical work at Berkeley concerning the electron spin resonance in Cu-Mn dilute alloy is pointed out and examined. It appears that the possibility could not be eliminated that the spin-lattice relaxation time of conduction electrons in the alloy due to mechanisms other than the s-d interaction is longer than previous authors have assumed. (auth)

22757

EXPANSION FORMULAE OF THE FREE ENERGY AND DISTRIBUTION FUNCTIONS IN POWERS OF THE ONE PARTICLE DISTRIBUTION FUNCTION. Tohru Morita

(Tokyo Inst. of Tech.). Progr. Theoret. Phys. (Kyoto) 21, 501-10(1959) Apr.

A new method is proposed which enables one to convert the formulas for a uniform multi-component system to those for a non-uniform one. As an application of the method, the expansion formulas of the free energy, potentials of average force and distribution functions for a non-uniform multi-component system are derived in a simple and systematic way. The formulas are obtained both for a continuous and for a lattice system. The formula obtained for the free energy for a continuous system coincides with that given by Arinstein, and the first few terms of the formulas for the free energy and the pair distribution function for a lattice system are identical to those given by Yvon. A procedure to convert the formulas for a continuous system to those for a lattice system and vice versa is given. (auth)

22758

NUCLEAR PHOTO-REACTION AND EXCITATION MODES OF NUCLEI. Saburo Fujii (Nihon Univ., Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 511-32 (1959) Apr.

Analyzing the excitation functions given by the experimental researches on the nuclear photo-reaction, it is found that there are two types of excitation mode of nuclei; the extra particle excitation and the core excitation. The careful comparison of the predictions by the single particle model with experimental data shows that these two types of excitation mode are distinguished in the photo-reaction of the light nuclei. It is indicated that the resonances observed in the (γ,n) reactions of C^{13}, N^{14} and F^{19} and $N^{14}(\gamma,p)C^{13}$ in the energy region of $10 \sim 15$ Mev are essentially due to the extra particle excitation. In the case of medium weight and heavy nuclei the resonances due to the extra particle excitation should appear, in many cases, at the energies lower than the thresholds for the (γ,n) or (γ,p) reactions. On the other hand, the giant resonance is characterized by the core excitation mode. For the description of the core the possibility that the collective model may be more reasonable than the simple independent particle model is indicated. And further, the distinction between these two models are discussed in detail. (auth)

22759

HYDROMAGNETIC PLANE STEADY FLOW IN COMPRESSIBLE IONIZED GASES. Yusuke Kato and Tosiya Taniuti (Kobe Univ., Japan). Progr. Theoret. Phys. (Kyoto) 21, 606-12(1959) Apr.

The magnetohydrodynamics in compressible gases of infinite conductivity is discussed under the assumptions that the flow is isentropic and steady and that the directions of flow velocity and of magnetic field are in the same plane. The hyperbolicity conditions for the starting equations, under which the discontinuity surfaces can appear, are investigated. The special case in which the flow is parallel to the direction of magnetic field is analyzed in detail. (auth)

22760

ON THE WAVE FUNCTIONS OF HIGHER SPIN PARTICLES. Shoichi Hori (Kanazawa Univ., Japan). Progr. Theoret. Phys. (Kyoto) 21, 613-24(1959) Apr.

The $2s + 1$ mutually orthogonal wave functions of a particle with spin s are explicitly worked out in the tensor formalism for a boson and in the Rarita-Schwinger formalism for a fermion, respectively. As an example of application, a method is described according to which an angular correlation function is calculated relativistically, in the case of an associated production of a hyperon and a kaon and their ensuing decays, assuming that they have higher spins. (auth)

22761

ISOTOPE SHIFT AND FERMI-SEGRÉ FORMULA. N. J. Ionesco-Pallas (Rumanian Inst. for Atomic Researches, [Bucharest]). Progr. Theoret. Phys. (Kyoto) 21, 655-7(1959) Apr.

The applicability of the Fermi-Segré formula for the estimation of isotope shift is discussed. Formulas are derived for the isotope shift by Broch's and Sommerfeld's methods as a means of justifying the Fermi-Segré formula. (C.J.G.)

22762

A THEORETICAL INTERPRETATION OF THE EFFECT OF RADIATION QUALITY ON YIELD IN THE FERROUS AND CERIC SULFATE DOSIMETERS. P. R. J. Burch (Univ., of Leeds, Eng.). Radiation Research 11, 481-97 (1959) Oct.

Data are tabulated on the assumed and calculated yield values for ferrous sulfate and ceric sulfate dosimeters exposed to cobalt-60 gamma radiation and to polonium-210 alpha particles. Results are compared with predictions for tritium beta particles. The basic Jaffé formula for combination between radicals diffusing from a cylindrical column is adapted to allow for back and competitive reactions. The adaptation of the Jaffé formula, application of combination formulas, experimental data on the hydrogen and hydrogen peroxide yield, and the formation of water by recombination are discussed. LET are also presented and discussed. Theoretical predictions and experimental data are compared. (C.H.)

22763

SENSITIVITY OF THE PHOTOGRAPHIC EMULSION TO BETA SPECTRA AND ITS DEPENDENCE ON THEIR AVERAGE ENERGY. R. K. Poddar (Saha Inst. of Nuclear Physics, Calcutta). Radiation Research 11, 498-508(1959) Oct.

The beta-particle sensitivity of Kodak autoradiographic stripping film was studied in terms of the average number of grains developed per incident beta particle. Data are tabulated. Analysis of the energy dependence of the sensitivity yielded a value of 1750 ev as the average energy necessary to render a photographic grain developable. (C.H.)

22764

X-RAY METHOD FOR STUDY OF EXPLOSIVELY ACCELERATED METAL SYSTEMS USING A 7-Mev ELECTRON LINEAR ACCELERATOR. Wilmot N. Hess, Marvin D. Martin, George C. McFarland, Wesley A. Rutz, and Jasper A. Welch, Jr. (Univ. of California, Livermore and Berkeley). Rev. Sci. Instr. 30, 794-9(1959) Sept.

A new x-ray technique for the study of explosively accelerated metal systems is described. X rays from a 7-Mev electron linear accelerator operated with a pulse length of 10 μsec pass through the assembly under study and are detected by NaI scintillators viewed by photomultipliers. Collimation is used to achieve time resolution of 0.2 μsec and space resolution of 0.025 cm parallel to the direction of motion and 1 cm perpendicular to the motion. (auth)

22765

SIMULTANEOUS DETONATION ALONG A LINE. J. O. Erkman (Stanford Research Inst., Menlo Park, Calif.). Rev. Sci. Instr. 30, 818-20(1959) Sept.

Some experiments for studying the effects of explosively induced shock waves require that the detonation front lie in a straight line in a thin sheet of explosive. Since explosives are conventionally point initiated, a device must be used to convert the curved detonation front into a straight front. This conversion was achieved in a practical fashion by point initiating a thin sheet, properly shaped, of easily molded explosive. Some satisfactory shapes which can be produced by standard shop methods are described. (auth)

22766

DETERMINATION OF TURBULENCE CHARACTERISTICS OF SOLID PARTICLES IN A TWO-PHASE STREAM BY OPTICAL AUTOCORRELATION. S. L. Soo, C. L. Tien, and V. Kadambi (Princeton Univ., N. J.). Rev. Sci. Instr. 30, 821-4(1959) Sept.

Application of optical autocorrelation techniques enables determination of Lagrangian correlation, scale, and intensity of turbulent motion of solid particles in a two-phase stream. This method allows measurement of both longitudinal and transverse correlations. (auth)

22767

IMPROVED METHOD OF ETCHING BY ION BOMBARDMENT. T. K. Bierlein and B. Mastel (General Electric Co., Richland, Wash.). Rev. Sci. Instr. 30, 832-3(1959) Sept.

A procedure incorporating VHF excitation permits increased ionization and etching of specimens at pressures as low as 1 μ Hg. (C.J.G.)

22768

SCINTILLATIONS FROM LIQUID HELIUM. E. H. Thorndike and W. J. Shlaer (Harvard Univ., Cambridge, Mass.). Rev. Sci. Instr. 30, 838-9(1959) Sept.

Light pulse durations of 30 to 35 μsec were measured from both gaseous and liquid helium under alpha bombardment from a Po^{210} source. (D.E.B.)

22769

ABSORPTION AND LUMINESCENCE OF IMPURITIES IN ORGANIC COMPOUND CRYSTALS AT 20°K. II. SPECTRA OF NAPHTHACENE SOLUTIONS IN CRYSTALS OF CERTAIN UNCONDENSED AROMATIC HYDROCARBONS. A. F. Prikhot'ko and A. V. Solov'iov (Inst. of Physics, Academy of Sciences, USSR). Ukrain. Fiz. Zhur. 4, 229-38(1959) Mar.-Apr. (In Ukrainian)

The absorption and luminescence of naphthacene impurities in tolan, stilbene, and p-ditolyl crystals at 20°K are investigated. Polarization of certain bands, particularly pronounced at high concentrations of naphthacene, was observed in the absorption spectra of naphthacene impurities in the given crystals. (auth)

22770

CONDUCTIVITY MEASUREMENTS ON OXIDES OF THE RARE EARTHS. [PART] I. W. Noddack, H. Walch, and W. Dobner (Staatliches Forschungsinstitut für Geochemie, Bamberg, Ger.). Z. physik. Chem. (Leipzig) 11, 180-93(1959). (In German)

The voltage curves for Sc_2O_3, Y_2O_3, La_2O_3, Nd_2O_3, Sm_2O_3, Gd_2O_3, Dy_2O_3, Yb_2O_3, ZrO_2, $ZrO_2-Y_2O_3$, and $Yb_2O_3-Y_2O_3$ compacts were determined at various temperatures. The result showed that the conductivity of these oxides is probably an electronic and not an ionic conductivity. The equation for the conductivity temperature coefficient of semiconductors was studied with respect to its validity for the oxides. (J.S.R.)

22771

SOME PROPERTIES OF THE OXIDES OF THE RARE EARTHS. II. W. Noddack and H. Walch (Staatliches Forschungsinstitut für Geochemie, Bamberg, Ger.). Z. physik. Chem. (Leipzig) 11, 194-207(1959). (In German)

The electrical conductivity of the oxides Sc_2O_3, Y_2O_3, La_2O_3, Nd_2O_3, Sm_2O_3, Gd_2O_3, Dy_2O_3, Yb_2O_3, ZrO_2, CeO_2, Pr_6O_{11}, Ta_2O_5, and TaO_2 was measured in air and vacuum at various voltages and temperatures. The detection of oxygen, which should be released at the anode in ionic conductivity, was investigated. Polarization effects which should occur in material alteration of the oxides was also considered. All the results indicated an electronic conductivity in the temperature range from 873 to 1573° absolute. Some studies on the thermal reduction of Ta_2O_5 and TaO_2 and the reduction of rare earth oxides with atomic hydrogen are also presented. (J.S.R.)

22772

IONIC OSCILLATIONS IN A PLASMA. T. F. Volkov. Zhur. Eksptl'. i Teoret. Fiz. 37, 422-6(1959) Aug. (In Russian)

The effect of a high-frequency electromagnetic field on ionic oscillations in a plasma is considered. It is shown that the frequencies of the longitudinal quasi-acoustic oscillations of the plasma begin to depend on the amplitude of the field. Possible mechanisms for the appearance of instabilities are discussed. (auth)

22773

ON SOLUTION OF THE KINETIC EQUATION FOR A PLASMA IN A VARIABLE MAGNETIC FIELD. Yu. N. Barabanenkov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 427-9(1959) Aug. (In Russian)

The motion of a totally ionized plasma (collisions being neglected) along a narrow magnetic tube of an axially symmetrical magnetic field is considered by means of the kinetic equation. The equation is solved under the assumption of sufficiently slow variation of the magnetic field. Canonical variables are chosen as the independent variables of the distribution function. (auth)

22774

EFFECT OF INELASTIC COLLISIONS ON THE VELOCITY DISTRIBUTION OF ELECTRONS. L. M. Kovrizhnykh (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 490-500(1959) Aug. (In Russian)

The velocity distribution function for electrons in a weakly ionized plasma was found with consideration of inelastic collisions. It is found that at electron energies exceeding the excitation (ionization) energy, inelastic collisions lead to a sharp drop in the distribution function. (auth)

22775

MAGNETOSTRICTION OF ANTIFERROMAGNETIC NICKEL OXIDE. K. P. Belov and R. Z. Levitin (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 565-6(1959) Aug. (In Russian)

Magnetostriction of potycrystalline NiO prepared by standard ceramic technology was measured at room temperature. In fields up to 7000 gauss the magnetic susceptability depends slightly on the field and is equal to 6×10^{-6}; the Curie point determined by Young's modulus discontinuity was 251°C. The temperature depend-

ence of magnetostriction in a 14,200 gauss field and longitudinal and tranverse magnetostriction graphs are plotted. (R.V.J.)

22776

MEASUREMENTS OF MAGNETIC MOMENTS OF NUCLEI OF ALKALINE-EARTH METAL ATOMS BY MAGNETIC RESONANCE IN MOLECULAR BEAMS. A. G. Kucheryaev, Yu. K. Szhenov, and Sh. M. Gogichaishvili (Inst. of Physics and Tech. Academy of Sciences, Georgian, SSR). Zhur. Ekspti'. i Teoret. Fiz. 37, 582-3(1959) Aug. (In Russian)

Magnetic moments of Ba^{135}, Ba^{137}, Ca^{43}, Mg^{25}, and Sr^{87} were measured by magnetic resonance in molecular beams in the S. state. It is shown that with the suggested apparatus the measurements can be carried out in all alkaline-earth metal atomic beams. The beam intensity, source temperature, and surface ionization factor are tabulated as well as the magnetic moment μ (with diamagnetic corrections) in magnetons. The magnitude of the Ba^{137} and Ba^{135} resonance frequency ratio was 1.1187 ± 0.0003. All obtained magnetic moments are in good agreement with the magnitudes obtained by nuclear induction methods. (R.V.J.)

22777

THE STRUCTURE OF A STEADY MAGNETOHYDRODYNAMIC SWITCH-ON SHOCK WAVE. Z. O. Bleviss (Douglas Aircraft Co., Inc., Santa Monica, Calif.). p.27-40 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

The structure of a steady magnetohydrodynamic "switch-on" shock wave is studied for the case where the magnetic diffusivity is large compared with the viscous and thermal diffusivities. Analytic results are obtained for the case of constant electrical conductivity and a perfect gas, and a single numerical integration extends the results to variable electrical conductivity. As in the case of the "parallel" magnetohydrodynamic shock wave studied by Marshall, it is found that if the initial magnetic field strength is less than a certain critical value, a sharp, purely fluid-mechanical shock wave is preceded by a wide region in which all quantities change slowly; when the field strength is greater than this critical value, no sharp shock occurs and all quantities change slowly over a wide region. Calculated results for these two cases are presented; the distributions of various quantities and the shapes of the streamlines and the magnetic field lines are shown for constant electrical conductivity. The shock wave thickness and the validity of some of the assumptions are discussed. (auth)

22778

HIGH TEMPERATURE GAS MIXTURES FOR SIMULATING AIR AND OTHER PLANETARY ATMOSPHERES. K. E. Tempelmeyer (Arnold Engineering Development Center, Tullahoma, Tenn.). p.207-21 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

A set of simultaneous equations has been proposed for specifying a mixture of gases which has macroscopic properties similar to those of another gas or some other gas mixture at the same pressure and temperature. Although the equations directly consider only a few basic molecular properties (mean molecular mass, number of degrees of freedom, and collision cross-sectional area), the gas mixture they specify also duplicates many of the equilibrium and transport properties of the simulated gas or mixture. Similarity parameters for fluid flow and heat transfer are also matched. Air at temperatures up to the dissociation range may be simulated by mixtures primarily composed of a combustion gas with monatomic and diatomic gases as additives. Moreover, the temperature variation of the properties of air is closely reproduced by certain of these air-equivalent mixtures. Gas mixtures equivalent to the proposed atmospheres of other planets may also be determined. For example, the atmospheres believed to exist on Mars or Venus can be duplicated at temperatures near 600°R by mixtures which contain a large proportion of air with gases of the Freon family as additives. (auth)

22779

GLOVE BOXES AND SHIELDED CELLS FOR HANDLING RADIOACTIVE MATERIALS. A Record of the Proceedings of the Symposium on Glove Box Design and Operation held in the Cockcroft Hall, A.E.R.E., Harwell, on February 19th to 21st, 1957. G. N. Walton, ed. New York, Academic Press, Inc., 1958. 523p.

This volume is divided into two parts. Part one is devoted to unshielded boxes and includes safety, design and manufacture, constructional materials, decontamination, layout in laboratories, inert atmospheres, handling of Po, operations with gaseous materials, metallurgical glove box practice in the USA, development for metallurgical studies, adaptation of standard boxes to metallurgical operations, metal fabrication plants, and large scale operations. The second part discusses shielded cells and includes shielding calculations, viewing and handling equipment, design of shielded cells, operations on β-ray emitters, Pu handling for a critical experiment, operations on multicurie cesium sources, and operations on irradiated fissile materials. (W.L.H.)

22780

FABRICATION OF NEUTRON SOURCES. J. H. Birden (to U. S. Atomic Energy Commission). U. S. Patent 2,883,553. Apr. 21, 1959.

A method is presented for preparing a neutron source from polonium-210 and substances, such as beryllium and boron, characterized by emission of neutrons upon exposure to alpha particles from the polonium. According to the invention, a source is prepared by placing powdered beryllium and a platinum foil electroplated with polonium-210 in a beryllium container. The container is sealed and then heated by induction to a temperature of 450 to 1100°C to volatilize the polonium off the foil into the powder. The heating step is terminated upon detection of a maximum in the neutron flux level.

Elementary Particles

22781 AFOSR-TN-59-819

Maryland. Univ., College Park.

K^--NUCLEON SCATTERING LENGTHS AND THE K^--d INELASTIC CROSS SECTION. Technical Report No. 146. T. B. Day and J. Sucher. July 1959. 8p. Contract AF49(638)-24.

Results are presented of a alculation of elastic plus inelastic cross sections using closure and the multiple "approximate" Brueckner model. (W.D.M.)

22782 AFSWC-TR-58-47

Republic Aviation Corp. Missile Systems Div., Mineola, N. Y.

MOTIONS AND RADIATION OF A POINT CHARGE IN

A UNIFORM AND CONSTANT EXTERNAL MAGNETIC FIELD. H. Rosner. Nov. 15, 1958. 455p. Project No. 5776. Contract AF29(601)-1218. (MSD-206-950-3; AD-208852).

The trajectories of a charged particle moving in a constant and uniform magnetic field are evaluated on the assumption that no radiation loss occurs. The radiation field with all its properties is then determined on the basis of these trajectories. From the resulting rate of energy dissipation, the orbital variables are obtained as slowly varying functions of the time. The previously derived zero-order radiation field is corrected to first order, by introducing the weakly time-dependent orbital parameters into all significant expressions. (auth)

22783

THE TRANSITION CURVE OF THE ELECTRON-PHOTON COMPONENT OF EXTENSIVE AIR SHOWERS IN LEAD ABSORBER OF THICKNESS BETWEEN 0 AND 25 cm. J. Babecki, L. Jurkiewicz, J. M. Massalski, and M. Mieswicz (Academy of Mining and Metallurgy, Krakow). Acta Phys. Polon. 16, No. 1-2, 119-33(1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 15208.)

Measurements were made of the absorption curve for particles of extensive atmospheric showers with the aid of the ordinary setup for the registration of extensive showers. Simultaneously eight types of coincidences at two positions of the lead absorber were recorded with respect to the rows of the telescope counters. The thickness of the absorber was varied from 0 to 25 cm. On the basis of the results obtained, the ratio p/e of the number of photons to the number of electrons in extensive atmospheric showers was calculated and found to be equal to 0.70 ± 0.15. All the results of the measurements made by other authors, connected with the determination of p/e, were analyzed. It is shown, that among the particles leaving the lead absorber of thickness of several centimeters, there exists a large number of penetrating photons of low energy, and that these may be recorded by individual rows of counters, but are not recorded by a telescope consisting of two or three rows of counters. The mechanism of registration corresponds to that proposed by Greisen. (auth)

22784

SURVEY OF THE HYPERFRAGMENT EXPERIMENTAL DATA. A. Filipkowski, J. Gierula, and P. Zielinski (Inst. of Nuclear Research, Warsaw). Acta Phys. Polon. 16, 139-50(1957). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 5115.)

From the 120 decays of hypernuclei known in the literature, 72 decays are chosen that are known to be without any doubt. On the basis of an analysis of these decays, certain statistical conclusions are drawn relative to the generation, decay, binding energy, structure and lifetime of hypernuclei. Tables are given that facilitate the determination of the binding energy of a Λ^0 hyperon in light hypernuclei.

22785

ON A SCREW MODEL OF PARTICLES IN ISO-SPACE. Jerzy Rayski (N. Copernicus Univ., Torum, Poland). Acta Phys. Polon. 16, No. 4, 279-91(1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 15024.)

For each particle (including leptons) the attribute $a_3 = b - q - t_3$, where b is the number of baryons minus the number of anti-baryons, q is the charge, and t_3 is the projection of the isotopic spin on the "electromagnetic axis" in the isotopic space is derived. In analogy with t_3, the attribute a_3 is interpreted as the projection of the supplementary momentum in the isotopic space (value a) consisting in turn, for the case of half integer a, of an "orbital" and "spin" part. It is proposed that the fundamental portion of the particle mass is due to this momentum (non-field "mechanical" mass). Equations are proposed in isotopic space, which lead to a spectrum of "mechanical" masses which is in good agreement with experiment. The "mechanical" mass of π mesons is 0 ($a_\pi = 0$). The direction of the "electromagnetic axis" in the isotopic space is given by the particle itself; together with the direction of the "rotation" it forms a screw, which is righthanded for the particle and lefthanded for the anti-particle. The total isotopic momentum is conserved both for strong and for weak interactions. The redistribution of the momentum between the isotopic spin and the supplementary momentum in reactions with weak interaction can be attributed to the existence of a particle in isotopic space—isotrino—which carries an isotopic moment of one half.

22786

MULTIPLE PRODUCTION OF MESONS UPON COLLISION OF MESONS WITH NUCLEONS. E. Friedlander. Acad. rep. populare Romîne, Inst. fiz., Studii cercetări fiz. 8, 379-81(1957). (Translated from Referat. Zhur. Fiz. No. 12, 1958, Abstract No. 26895).

The difference in the structure of the two colliding particles affects the angular and energy distributions of the particles that are formed by the collision. The author calculates the central collision of two different particles (for example a pion and a nucleon) with allowance for the fact that the mass is differently distributed in the particles of different types. The results obtained show that there exists a symmetry in the energy and angular distribution of the mesons produced by the collisions.

22787

ON A PROBLEM OF SLOWING DOWN NEUTRONS. M. Uzsoky (Hungarian Academy of Sciences, Budapest). Acta Tech. Acad. Sci. Hung. 20, 271-4(1958). (Translated from Referat. Zhur. Fiz. No. 1, 1959, Abstract No. 514).

Neutron slowing down in a homogeneous medium without absorption is examined. The deviation of the collision density from the asymptotic form is examined. It is shown that a threshold for the deviation exists which cannot be reduced substantially.

22788

THE ENERGY DEPENDENCE OF LOW ENERGY K^--PROTON PROCESS. R. H. Dalitz and S. F. Tuan (Univ. of Chicago). Ann. Phys. (N. Y.) 8, 100-18(1959) Sept.

Assuming the K^--proton interaction to have negligible range, the energy dependence of the cross sections for elastic scattering, charge exchange, and reaction processes is discussed, taking into account the dominant effects of the K^--K^0 mass difference. The formulas obtained are used for the discussion of the cusps which appear at the K^--p and $\bar{K}^0$-n energy thresholds and for the analytic continuation of the scattering amplitude into the unphysical region of negative K^--p energies which is of relevance for the use of the K-meson dispersion relations. Four sets of scattering amplitudes are obtained consistent with all the present data on K^--proton interactions and the possibilities for discrimination be-

tween them are discussed. Two of these amplitudes are found to correspond to a resonance-like behavior just within the unphysical region. (auth)

22789

STATISTICAL TIME MOMENTS AND AN ASYMPTOTIC FORMULA FOR THE TIME-ENERGY DISTRIBUTION OF SLOWED-DOWN NEUTRONS. Karl-Erik Eriksson (Univ. of Uppsala). Arkiv Fysik 16, 1-14(1959).

Starting with Waller's exact solution to the problem of neutron slowing-down by elastic collisions against free atoms at rest, the exact time moments and the conditions for their existence are derived. The treatment considers both positive and negative moments. An asymptotic formula is derived from Waller's solution which is valid for large values of a variable x, which is the collision number multiplied by the time elapsed since neutron entry. For small neutron energies a formula is derived which is directly comparable with formulas derived by Marshak and Van Darel by means of the method of moments. These formulas are correct only to the first order if expanded in powers of 1/x. The second non-vanishing term of the expansion obtained for the distribution function by Olsson is calculated in the form of a power series in time. Calculations are diagrammed for deuterium and carbon moderators based on a formula first derived by Svartholm which appears to give the correct asymptotic distribution function for neutron energies, much smaller than the initial energy. (C.J.G.)

22790

THE DISINTEGRATION OF DEUTERONS BY ELECTRONS. M. Suffczynski (Institute of Physics, Polish Academy of Sciences, Warsaw). Bull. acad. polon. sci. Classe III 5, No. 9, 887-91(1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 15114.)

The polarization of protons during disintegration of deuterons by unpolarized electrons is calculated. The nucleons were assumed to be point particles, and the electromagnetic interaction was considered in the dipole approximation. The magnitude of the polarization depends substantially on the type of interaction between the neutron and the proton. The maximum polarization reaches 28%, if one assumes the nuclear forces to be central, with a zero radius of action.

22791

INTERACTIONS OF ELEMENTARY PARTICLES. Parviz Merat (Institut Henri Poincaré, Paris). Compt. rend. 249, 640-1(1959) Aug. 3. (In French)

A classification of elementary particles based on their interactions is presented. A physical interpretation is found for strangeness. The hyperons Σ^-, Σ^+, Σ^0, and Λ^0 appear as particles with no meson (π) interaction. Four new leptons ρ^0, ρ^-, ω^0, and ω^+ with a mass higher than the mass of the k meson results from the theory. (tr-auth)

22792

INTERACTION OF NUCLEONS AT ENERGIES OF $10^{14}-10^{15}$ ev/NUCLEON. J. Pernegr, V. Petrzilka, and J. Vrana (Czechoslovak Academy of Sciences, Karlovy Vary). Czechoslov. J. Phys. 8, 67-76(1958). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 5267.)

Description is given of a jet of type 0 + 14 at an energy of $3.3^{+1.1}_{-0.7} \times 10^{14}$ ev/nucleon, observed in a stack of exposed nuclear emulsions. From the axis of the meson jet at a distance of 4.2 mm from the primary interaction, there was observed a secondary interaction with an unexpectedly small multiplicity of the type 0 + 4, apparently produced by the following nucleon from the primary particle. The particles of a narrow cone form an angle on the order of 10^{-4} radians with the axis of the jet, and the particles of the diffused cone form an angle on the order of 10^{-2} radians. Such a clear anisotropy appears also in the center of mass system. Diffraction of the primary energy transferred to the produced particles was found to be on the order of 15%. An exceedingly large number of electron pairs was observed in the jet. The interpretation of the entire phenomenon is in good agreement with the Heisenberg theory of multiple production of mesons.

22793

BETA DECAY MATRIX ELEMENTS IN THE STRONGLY DEFORMED NUCLEI. Gaja Alaga. Glasnik mat. fiz. i Astron., Ser II, 12, 245-56(1957). (Translated from Referat. Zhur. Fiz. No. 1, 1959, Abstract No. 403).

General formulas needed for calculation of the matrix elements in beta decay of strongly-deformed nuclei are derived. A collective model of the nucleus is used and single-particle wave functions are determined in the form obtained by Nilsson.

22794

ON THE THEORY OF THE ENERGY SPECTRUM OF SYSTEMS OF INTERACTING PARTICLES. V. M. Yeleonskii and P. S. Zyryanov. Izvest. Vysshikh Ucheb. Zavedenii, Fiz., No. 6, 152-7(1958).

Dispersion equations for a system of interacting particles having small density fluctuations are arranged. For this purpose instead of the complex functions $\Psi_j(xt)$ real functions are introduced by putting $\Psi_j = \rho_j^{1/2}(xt)e^{iS_j(xt)h^{-1}}$. Linearization in the neighborhood of exact solutions gives the equations, $S_j = S_{oj} = -E_{oj}t + p_j x$, $\nabla S_{oj} = p_{oj} = mV_{oj}$, $\rho_j = \rho_{oj} = \text{const} = \frac{1}{V} = 1$. These relations are then used to obtain dispersion equations for boson and fermion systems. (TCO)

22795

ON THE POSSIBILITY OF DETECTING SYNCHROTRON RADIATION FROM ELECTRONS IN THE VAN ALLEN BELTS. R. B. Dyce (Stanford Research Inst., Menlo Park, Calif.) and M. P. Nakada (Univ. of California, Livermore). J. Geophys. Research 64, 1163-8(1959) Sept.

It is known that a moving charged particle can be trapped in the earth's magnetic field indefinitely. Indeed, high-speed charged particles, presumably electrons, have recently been observed in nature by United States satellites and lunar probes. These electrons are relativistic and should emit radiofrequency wide-band noise similar to that observed in synchrotrons even as high as optical frequencies. Most of this energy is unable to reach the earth's surface because of reflection from the intervening ionosphere. A small fraction of this energy, however, exists at VHF capable of passing down through the ionosphere. It would be desirable to conduct an experimental search for this radiation in order to learn more about the electron energies that exist and to allow observation of the Van Allen belt as a function of time. (auth)

22796

ANGULAR CORRELATION OF NUCLEAR RADIATION. Jozsef Mraz. Magyar Fiz. Folyóirat 5, No. 3, 217-28 (1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 14069.)

A brief discussion is presented of the semi-classical theory of angular correlation of gamma quanta. A setup

for the measurement of angular correlation constructed at the Central Physics Research Institute, Hungary is described.

22797

NOMOGRAMS FOR MEASUREMENT OF ENERGY OF NEUTRONS IN PHOTOEMULSION. Erno Bujdoso, Laszlo Medveczky, and Sandor Totok. Magyar Fiz. Folyóirat 5, No. 3, 229-39(1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 14983.)

A description is given of nomograms with which it is possible to determine the energy of neutrons in photoemulsions in the energy interval from 0.5 to 14 Mev with an accuracy of 1 to 3%.

22798

CERTAIN PROBLEMS OF SLOWING DOWN OF NEUTRONS. Lenard Pal. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 1, 41-54 (1956). (Translated from Referat. Zhur. Fiz. No. 12, 1958, Abstract No. 27026).

Exact expressions are derived for the collision density and for the resonant capture escape probability of neutrons in stationary conditions in the case of a nonabsorbing homogeneous moderator. The solution is generalized to include absorbing and inhomogeneous moderator. (auth)

22799

REMARKS ON THE STRUCTURE OF STRANGE PARTICLES. Geza Gyorgyi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 315-25(1957). (Translated from Referat. Zhur. Fiz. No. 12, 1958, Abstract No. 26901).

A survey is given of papers devoted to a theoretical explanation of the properties of strange particles. A presentation is made of hypothesis that hyperons are excited states of nucleons, and of another point of view, whereby the real elementary particles are the fermions, while the bosons consist of nucleons and antinucleons. The advantages and shortcomings of each conception are discussed.

22800

DISTRIBUTION OF ENERGY OF "EVAPORATING" CHARGED PARTICLES. Judit Nemeth. Magyar Tudományos Akad. Központi Fiz. Kutatö Intézetének Közlemenyei 5, 436-441(1957). (Translated from Referat. Zhur. Fiz. No. 1, 1959, Abstract No. 446).

It is known that protons with energy much less than the energy of the Coulomb barrier are evaporated from excited nuclei. This phenomenon can be explained by taking into account the surface oscillation of the nucleus, from which the evaporation takes place.

22801

DETERMINATION OF THE RATIO OF THE NUMBER OF PHOTONS TO THE NUMBER OF ELECTRONS IN EXTENSIVE COSMIC SHOWERS WITH THE AID OF A CLOUD CHAMBER. Istvan Dohun, Tibor Gemesy, Tamas Sandor, and Antal Somogyi. Magyar Tudományas Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 461-8(1957). (Translated from Referat. Zhur. Fiz. No. 12, 1958, Abstract No. 27042).

The investigations were carried out with a cloud chamber having an effective transverse section of 300 cm^2, in which seven plates of lead 33 mm thick each were placed. The chamber registered an extensive shower. During the interpretation of the resultant photographs, a count was taken both of the electrons entering the chamber and of the electron pairs produced by the photons in lead. Taking into account the possible number of photons passing through the chamber without interacting, the ratio of the number of photons to the number of electrons was found to be a = 1.16 for a photon with primary energy of 84 Mev. The resultant data were compared with the results of other workers.

22802

ANGULAR DISTRIBUTIONS OBTAINED ON THE BASIS OF DIFFERENT THEORIES OF MULTIPLE MESON PRODUCTION. Gyorgy Bozoki and Eva Gombosi. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 537-55, III(1957). (Translated from Referat. Zhur. Fiz. No. 12, 1958, Abstract No. 36896).

The dependence of differential and integral angular distributions of mesons on $\alpha = \gamma_0 \tau \vartheta$, for the case of nucleon-nucleon collisions were investigated. (γ_0 is the primary energy in the center-of-mass system in units of the nucleon rest mass, and ϑ is the angle of deflection of the particles from the vertical axis in the laboratory system). The results are compared with the distributions obtained in accordance with the Fermi and Heisenberg theory with angular distribution of the type $\cos^4 \vartheta$, respectively. For the case of the investigated angular distribution in jets, the results obtained in this manner make it possible to compare the experimental and theoretical distributions, and to determine the primary energy. In addition, on the basis of the Landau theory, the authors investigated the angular distribution for the case of nucleon-nucleus collisions.

22803

CONNECTION BETWEEN THE RECOIL OF THE NUCLEUS AND THE TRANSVERSE POLARIZATION OF THE BETA PARTICLES. Geza Fyorgyi and Herbert Uberall. Magyar Tudományos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 572-76, IV(1958). (Translated from Referat. Zhur. Fiz. No. 12, 1958, Abstract No. 26938.)

The probability of β decay for given neutrino momentum and momentum and polarization of the electron are calculated. At a fixed momentum of the neutrino, the transverse polarization of the β particles differs from zero. A possible experiment for the detection of this polarization is discussed.

22804

THE INTERPRETATION OF $\alpha-\alpha$ SCATTERING. Hans Wittern (Universität, Munich). Naturwissenschaften 46, 443-4(1959). (In German)

A semiphenomenological potential is derived from a consideration of the repulsion of single nucleons given by the Pauli principle and from the character of the shell model wave functions for the actual levels of the Be^8 compound nucleus and their excitation functions. The scattering phases are calculated from the potential. (J.S.R.)

22805

CALCULATION OF THE MAGNETIC MOMENTS OF NUCLEONS BY USE OF A MODIFIED PROPAGATOR. Jack L. Uretsky and Peter J. Redmond (Univ. of California, Berkeley). Nuclear Phys. 12, 485-93(1959).

Previous attempts to use modified propagators in field-theory calculations have been frustrated by the appearance of ghost states in the propagator when one tries to improve on conventional perturbation theory. Recently a method of eliminating these ghosts has been suggested. By following this suggested procedure it is possible to calculate the magnetic moments of nucleons by using a modified nucleon propagator, which should be

an improvement on simple perturbation theory without introducing any spurious infinities. This calculation was performed approximately and yields magnetic moments of +1.2 and −2.3 nuclear magnetons for the proton and neutron, respectively, compared with the experimental values of 1.8 and −1.9. The improvement over perturbation theory is achieved because of a strong damping of the nucleon recoil term. (auth)

22806

POSSIBLE SUPERFLUIDITY OF A SYSTEM OF STRONGLY INTERACTING FERMIONS. L. N. Cooper, R. L. Mills, and A. M. Sessler (Ohio State Univ., Columbus). Phys. Rev. 114, 1377-82(1959) June 15.

The possible superfluidity of a system interacting fermions is investigated on the assumption that an adequate description of the system in its "normal" state is given by independent fermions in a momentum-dependent potential. On the basis of this assumption we have investigated whether a correlated wave function of the form used by Bardeen, Cooper, and Schrieffer minimizes the ground-state energy. The nonzero terms in the expectation value of the Hamiltonian contain the modified kinetic energy and the full two-body potential between the fermion pairs. An integral equation is obtained in configuration space for the correlation function between pairs. This integral equation is meaningful even for potentials with hard cores and a nonzero solution implies the existence of a superfluid state. A variational method is devised which provides a criterion for superfluidity and a lower bound for the transition temperature into the superfluid state. It is found that a repulsive hard core does not in principle forbid the existence of a superfluid state, but whereas in the absence of a hard core an attractive two-body potential always leads to a superfluid state at sufficiently low temperatures, in the presence of a repulsive core there appears to be a critical strength of attraction needed to form a superfluid state. When the variational principle is applied to liquid He^3 or to nuclear matter, it is found for a wide class of trial functions that the system does not become a superfluid. (auth)

22807

SINGLE-PARTICLE ENERGIES IN THE MANY-FERMION SYSTEM. David J. Thouless (Univ. of California, Berkeley). Phys. Rev. 114, 1383-90(1959) June 15.

The ground state of the many-fermion system was examined, using perturbation theory, with particular attention to Brueckner's method. A study of the single-particle propagators in the ground state of the system sheds some light on the relation between the single-particle energies used, for example, in the optical model of nuclear reactions, and Brueckner's self-consistent energies. This leads naturally to the use of a renormalization factor to allow for propagation off the energy shell. It is possible to formulate the perturbation theory entirely in terms of graphs with no fermion self-energy parts, and this method is used to examine the approximations used for this problem, and to relate more closely the calculations of the ground-state energy and of other properties of the ground state. (auth)

22808

DETERMINATION OF ELECTRON POLARIZATION BY MEANS OF MOTT SCATTERING. Noah Sherman and Donald F. Nelson (Univ. of Michigan, Ann Arbor). Phys. Rev. 114, 1541-2(1959) June 15.

The results of a numerical calculation of the polarization asymmetry factor, $S(\theta) = [\delta(\theta)]^{\frac{1}{3}}$, and the single scattering cross section for the scattering of electrons by the unscreened Coulomb fields of gold and aluminum at energies of 75 and 121 kev are presented. The results for gold at 121 kev are compared with the Mohr and Tassie calculations for the same element and energy which include the effects of screening. This comparison (indicating a Mott asymmetry about 50% greater for the screened field at angles near 165°) suggests the desirability of more detailed investigation of screening effects in order to be confident of Mott scattering as a means of measuring the polarization of electrons in this energy region. (auth)

22809

FINITE-RANGE DELTA-FUNCTION POTENTIAL. M. Bolsterli (Univ. of Minnesota, Minneapolis). Phys. Rev. 114, 1605-8(1959) June 15.

The long-range part of the nucleon-nucleon potential is approximated by the finite-range delta-function potential: $V_{\text{singlet even}} = V_1\delta(r-a)$, $V_{\text{triplet even}} = V_3\delta(r-a) + V_T\delta(r-a)S_{12}$. The best fit to the low-energy n-p data is obtained when V_3 is repulsive and V_T is large. The uncertainties in the V's are of the order of 10%. (auth)

22810

POSITIVE PION PRODUCTION IN PROTON-PROTON COLLISIONS AT 450 Mev. Lee G. Pondrom (Univ. of Chicago). Phys. Rev. 114, 1623-32(1959) June 15.

The external proton beam of the Chicago cyclotron was used to study the reaction $p + p \rightarrow \pi^+ + n + p$ at 450 Mev. The reaction $p + p \rightarrow \pi^+ + d$ was also measured as a check on the equipment. A double focusing wedge magnet was used to observe the momentum distribution of pions at angles of 14°, 20.5°, and 30° in the laboratory system. The over-all resolution of the magnet system varied from 1.5 to 2.2%. A least squares fit of the $p + p \rightarrow \pi^+ + d$ data in the center-of-mass system gives $d\sigma/d\Omega \propto (0.38 \pm 0.20 + \cos^2\theta)$ with $\sigma = 1.47 \pm 0.12$ millibarns. The spectra for the unbound reaction were fitted to Ss, Sp, Ps, and Pp spectrum shapes predicted by the phenomenological theory of pion production. This fit gives $d\sigma/d\Omega \propto (0.40 \pm 0.08 + \cos^2\theta)$ with $\sigma = 1.80 \pm 0.7$ millibarns. The results of this fit were compared with the cross section for neutral pion production at 450 Mev. This comparison was found satisfactory for the amounts of the Ss, Sp, and Pp spectrum shapes found in this experiment, but an excessively large amount of the Ps shape, 0.38 ± 0.10 millibarns, was required to fit the data. The results show that $\sigma_{10}(Pp)$ is much smaller than was previously reported. An excitation function for the unbound cross section is predicted by this fit in terms of the phenomenological model, and is found to increase too rapidly at high bombarding energies. (auth)

22811

FIXED ANGLE DISPERSION RELATIONS FOR NUCLEON-NUCLEON SCATTERING. M. Cini (Università, Rome and Istituto Nazionale de Fisica Nucleare, Rome) and S. Fubini and A. Stanghellini (CERN, Geneva). Phys. Rev. 114, 1633-9(1959) June 15.

Dispersion relations in which the scattering angle θ is kept constant are proposed for nucleon-nucleon scattering. These relations are a direct consequence of a general representation proposed by Mandelstam and can be checked directly up to the fourth-order perturbation theory. An extrapolation procedure based on these dispersion relations is proposed with the purpose of obtaining an independent determination of the pion-nucleon

coupling constant and the possibility of discriminating between the different available sets of phase shifts. A first determination of the pion-nucleon coupling constant from these fixed-angle dispersion relations is attempted by means of a more direct extrapolation procedure, closely analogous to the effective range approximation, and a result in good agreement with the currently accepted value is obtained. (auth)

22812

HYPERFINE SPLITTING EFFECTS IN THE CAPTURE OF POLLARIZED μ^- MESONS. H. Uberall (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 114, 1640-5 (1959) June 15.

The effect of hyperfine splitting of μ-mesic atom ground states on the neutron asymmetry from muon capture was investigated in hydrogen, deuterium, and complex nuclei. It is shown that this can provide more information on the capture interaction than the neutron asymmetry from spinless nuclei. Muon polarizations and gyromagnetic ratios in the hyperfine states are also discussed. (auth)

22813

PARITY OF THE K MESON AND THE Λ BETA-DECAY BRANCHING RATIO. C. H. Albright (Princeton Univ., N. J.). Phys. Rev. 114, 1648-50(1959) June 15.

The related problems of Λ beta decay and $K_{\mu 2}$ decay (via a Λ-antiproton loop) are studied. Dispersion techniques are used to calculate the vector (axial vector) Fermi interaction coupling constant from the known $K_{\mu 2}$ lifetime and reasonable values of the strong coupling constant for the scalar (pseudoscalar) K case. Each weak coupling constant is then used to place a lower limit on the Λ beta-decay branching ratio with the result that the limit with a pseudoscalar K is more than one order of magnitude smaller than that with a scalar K meson. The experimental information is essentially consistent with either K parity, for the observed branching ratio is approximately equal to the lower limit predicted for the scalar K case. (auth)

22814

$K_{\mu 2}$ DECAY AND LEPTONIC DECAY OF HYPERONS. B. Sakita (Univ. of Rochester, N. Y.). Phys. Rev. 114, 1650-1(1959) June 15.

The partial lifetime of $K \rightarrow \mu + \nu$ is calculated by dispersion techniques assuming that the K meson is pseudoscalar and that the relevant Fermi interactions are of the V-A type. The results are compared with experiments and it is concluded that the renormalized axial vector coupling which is respon.ible for the leptonic decay of hyperons is much smaller than the usual universal Fermi interaction. (auth)

22815

WAVE FUNCTION FOR THE FREE ELECTRON. I. THE COULOMB POTENTIAL. R. G. Breene, Jr., and Maria C. Nardone (General Electric Co., Philadelphia). Phys. Rev. 115, 93-6(1959) July 1.

The wave function for a free electron in the presence of an atom is considered for the case of the Coulomb potential, a potential which ignores both the effects of electron exchange and core polarization. A sample calculation involving the neutral oxygen atom is carried through. From the single-determinant wave function for the ^3P ground state of this atom the Coulomb potential is developed, and the important parts of the potential for the s- and d-wave portions of the free-electron wave function are considered. The relevant Schroedinger equations are solved by means of an IBM 704 program which is written so as to be readily adaptable to electrons in the presence of other atoms or ions having electrons through 2p. In our oxygen example the wave function calculations were carried out for values of the free-electron linear momentum ranging from 0.01 through 0.80 atomic unit. (auth)

22816

THREE-PION CONTRIBUTION TO THE ELECTROMAGNETIC STRUCTURE OF THE NUCLEON. B. Bosco and V. De Alfaro (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Phys. Rev. 115, 215-19(1959) July 1.

The contribution of three pions to the scalar electromagnetic form factors of the nucleon is computed by using the fixed source meson theory without rescattering corrections. The $(\gamma,3\pi)$ interaction is taken phenomenologically as a point interaction. It is shown that for those values of the $(\gamma,3\pi)$ coupling constant compatible with photoproduction experiments, the experimental charge distribution could be roughly fitted with a cutoff in the dispersion integral of the order of 7 pion masses. (auth)

22817

MEASUREMENT OF μ^+ LIFETIME. J. Fischer, B. Leontic, A. Lundby, R. Meunier, and J. P. Stroot (CERN, Geneva). Phys. Rev. Letters 3, 349-50(1959) Oct. 1.

The remarkable agreement of the experimental with the theoretical value for the lifetime of the muon is the strongest indication that the vector current is conserved and the strengths of axial and polar vector currents are equal when strong interactions are not present. An experiment to remeasure the μ^+ lifetime is described. A value of 2.20 ± 0.015 μsec was obtained. (W.D.M.)

22818

ON THE RELATION BETWEEN THE PHASE SHIFT AND THE NUMBER OF BOUND STATES. Masakuni Ida (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 21, 625-39(1959) Apr.

Some features of the Low equation are studied for Dyson's model. To select a unique solution the relation between the phase shift and the number of bound states is important. This relation is investigated more generally. It is connected with the energy spectra of the free Hamiltonian. The relation between the phase shift and the number of resonant states is also shown. Resonances are classified into two types and some differences in their properties are stated. (auth)

22819

ON THE TRANSFORMATION PROPERTIES OF THE DIRAC EQUATION. Pong Y. Pac (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 21, 640-52(1959) Apr.

In connection with two types of 3-dimensional rotation groups, which are termed the helicity and the pseudo-helicity group respectively, a synthesis and generalization of the Foldy-Wouthuysen-Tani transformation and the Cini-Toushek transformation for the Dirac Hamiltonian is discussed. One is thus enabled to comprehend in one scope the extreme-non-relativistic and the extreme-relativistic limits of the behavior of the free Dirac particles. Moreover, the parity-conserving and the parity-non-conserving interactions of the V-A form are derived on the basis of the principle of invariance of the interaction Hamiltonian for the continuous group of transformations corresponding to the extreme-relativistic case. (auth)

22820

A NOTE ON THE FUNDAMENTAL SYMMETRY OF

ELEMENTARY PARTICLES. Takao Okabayashi (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 653-5 (1959) Apr.

Recent experiments support the hypothesis that weak interactions are universally V−A combinations. Also, the so-called T-invariance of the law of nature may also be considered to hold at least in the zeroth approximation. It is on these two characteristic features that formulation of a more symmetrical world of elementary particles is attempted. (C.J.G.)

22821

ON THE THEORY OF BREMSSTRAHLUNG OF ELECTRONS BY PROTONS. G. L. Visotskii and A. A. Kresnin (Inst. of Physics and Tech., Academy of Sciences, USSR). Ukrain Fiz. Zhur. 4, 164-6(1959) Mar.-Apr. (In Ukrainian)

The differential cross section of bremsstrahlung of electrons by protons was calculated, taking into account the anomalous magnetic moment of the proton. A phenomenological account of the proton form factor is given. (auth)

22822

VIBRATING SOUND METHOD FOR INVESTIGATING AXISYMMETRICAL ELECTRON BEAMS. I. K. Ovchinnikov and M. S. Zinchenko. Ukrain. Fiz. Zhur. 4, 219-27(1959) Mar.-Apr. (In Ukrainian)

A vibrating sound method is proposed for measuring the parameters of intense electron beams. The sound, which rapidly crosses the electron beam, assimilates the current $I(r_\vartheta)$. The magnitude of the current is determined by the equation

$$I(r_\vartheta) = \int_{S(r_\vartheta, U_3)} (j - \sigma j + \sigma j \int_0^{\sqrt{2\eta(U_3-U)}} f(v)\, dv)\, dS,$$

where r_ϑ is the coordinates of the sound, $S(r_\vartheta, U_3)$ is the area of the beam section from which electrons strike the sound, j is the current density, σ is the coefficient of secondary emission, $\eta = e/m$ is the ratio of the electron charge to its mass, U_3 is the sound potential, U is the space potential, v is the velocity of the secondary electrons, and f(v) is the distribution function. The function of the sound current $I(r_\vartheta)$ can be determined by means of oscillography. The radial distribution of the electron velocity is defined by a comparison of the two sound current functions with two different potentials of the sound. The theory and some experimental results illustrating the possibilities of the method, are discussed. (auth)

22823

ON THE FORCES ACTING BETWEEN NUCLEONS AND HYPERONS IN ACCORDANCE WITH THE MESON THEORY. Yu. V. Novozhilov and L. V. Prokhorov. Vestnik Leningrad. Univ., Ser. Fiz. i Khim., No. 4, 80-92(1958).

The contribution of π-mesons to the nucleon-hyperon-potential without making use of the perturbation theory was investigated. In investigating the hyperon-nucleon-potential, the computation of the potential ought to be possible within the scope of the nonrelativistic theory. It is assumed that in the case of scattering of π-mesons on hyperons the cross section has a resonance character and that the latter is very considerable so that it is possible to neglect the non-resonance cross section, if there is no maximum of the scattering cross section of π-mesons in the non-relativistic energy range this theory is not permissible. The potentials differ with respect to the degree of their decrease with growing distance; the velocity-dependent terms in the potential are calculated with linear approximation. The meson cloud is of quasi-static character. Within the framework of this theory of scattering of the dressed particles, expressions are set up for the nucleon-hyperon adiabatic and the velocity-dependent potential and simplified for the non-relativistic case. The asymptotic expansions of these potentials are computed. In continuation of this, the properties of the operator θ are investigated and the possible resonant condition of the scattering of pions and hyperons is determined. It is impossible to obtain the two terms $W_{\vartheta\sigma}$ and $W_{\sigma\sigma}$ by the perturbation theory. $W_{\vartheta\sigma}$ contains the pion-nucleon scattering cross section σ_1 or the pion-hyperon cross section σ_2 linearly, whereas $W_{\sigma\sigma}$ depends quadratically on σ_1. (TCO)

22824

DRESSED PARTICLES IN QUANTUM FIELD THEORY. Yu. V. Novozhilov. Vestnik Leningrad. Univ., Ser. Fiz. i Khim., No. 4, 93-106(1958).

The general form of introducing independent fields for the description of dressed particles and groups of particles not in interaction are considered. A description of the dressed particles with diagonal free Hamiltonian is also presented. This theory is applied to the connection of the asymptotic states, with the states of the dressed particles not in interaction. For this investigation independent meson, nucleon, and antinucleon creation and annihilation operators were introduced for each particle cloud and the basic functions were determined in terms of this operation. The expression for the S-matrix has to contain the weight operator. The effective nonhermitian Hamiltonian was obtained. The term of interaction H_{12} describes the effect of meson, nucleon, and antinucleon exchange between the individual dressed particles. The S-matrix can be set up in a form quite analogous to the scattering theory with operator H_{12} as perturbation. A representation, in which the Hamiltonian of the free dressed particle H_0 is in diagonal position, was introduced. It is possible to develop the perturbation method in the dressed particle representation in which perturbation contains only the interaction of real particles. (TCO)

22825

ON THE DENSITY OF ELECTRIC CHARGE OF TWO NUCLEONS IN STATIC MESON THEORY. M. A. Braun. Vestnik Leningrad. Univ., Ser. Fiz. i Khim., No. 4, 107-18(1958).

As an approach to this problem the matrix elements $\langle f|\rho(\vec{r})|i\rangle$ are investigated, where $\rho(\vec{r})$ denotes the operator of the charge density of two physical nucleons in the current $\vec{r}$ and $|f\rangle$ and $|i\rangle$ denote the initial and final states of these nucleons. For $|i\rangle$ the adiabatic approximation is used. The $|i\rangle$-state is a singlet state in the sense of the isotropic spin. For the computation of the matrix element $\langle f|\rho(\vec{r})|i\rangle$ it is necessary to compute the static matrix element (the matrix element of the charge density) with certain omissions. The terms of the matrix element which disappear in the case of an increasing nucleon-interval R are expressed by $e^{-n\mu R}$ ($n > 2$, μ rest mass of the pion). Charge-density of the naked nucleon and meson cloud are separately computed. The results are used for the unelastic electron-deuteron scattering cross section. It was found that for an energy transfer up to 50 Mev the meson corrections may be used by introducing proton and neutron charge form factors, and the deformation of the meson clouds caused by the interaction of nucleons may be neglected. (TCO)

22826

ANNIHILATION OF THE POSITRON IN e^+H^-. A. A.

Tkachenko. Vestnik Leningrad. Univ., Ser. Fiz. i Khim., No. 4, 167-71(1958).

The time of annihilation and the angular distribution of the positron γ-quanta are computed. The basis is the positron annihilation cross section in e^+H^- in case of a formation of γ-quanta: $w(\vec{k}) = \pi r_0^2 c\rho(\vec{k})$. $\tau_H = 1/w$ results in $\approx 10^{-9}$ sec. For the angular distribution of the γ-quanta the expression $w(k) = a(1 + k^2/\alpha^2)^{-4}\ (1 + f(k))^2$ holds, for the experimental angular distribution $w(k_z) = a'(1 + 0,\ 3\theta^2)^{-3}$ holds. An experimental investigation was carried out of the annihilation of the positron in LiH. In this case the annihilation of the positron takes place either by a scattering on Li^+, H^-, or by (e^+H^-), or by the formation of a bound state $(e^+H^-)^*$. To decide whether the form (e^+H^-), or $(e^+H^-)^*$, or perhaps $(e^+$ halogen$^-)$ are involved, in annihilation of the positron it is suggested that the time of annihilation and the angular distribution under different physical influences be determined, from which conclusions on the annihilation-mechanism can be drawn. If a state e^+H^- is not concerned, it is impossible to use the experimental values for $w(k_z)$. (TCO)

22827

ON POLARIZATION EFFECTS FOR PHOTON DECELERATION RADIATION OF AN ELECTRON. I. M. Nadzhafov. Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim. 13, No. 3, 139-50(1958).

The elliptic polarization of the photon for the deceleration radiation of an electron is investigated. The principal result of the explicit theroretical investigation of the processes is the statement that only polarized electrons can generate an elliptically polarized radiation. (TCO)

22828

SCATTERING OF THE DIRAC PARTICLES ON THE SPHERICAL SYMMETRIC POTENTIAL IN THE DAMPING THEORY. I. I. Guseynov. Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim. 13, No. 3, 151-60(1958).

Dirac particle scattering by a fixed center of force with spherical symmetry and small radius of action under the influence of damping is considered. The differential scattering cross section of an unpolarized beam of Dirac particles and the integral effective cross section of the elastic scattering are calculated. The results are applied to scattering by the Yukawa-potential and by a potential limit. The results achieved cannot be obtained by means of the perturbation theory. (TCO)

22829

PRECISION DETERMINATION OF THE SPECIFIC CHARGE OF AN ELECTRON BY THE BUSCH METHOD. Gerhard Dietzmann. Wiss. Z. Karl-Marx-Univ. Leipzig, Math. Naturw. Reihe 4, Nos. 1-2, 163-92(1954-55). (Translated from Referat. Zhur. Fiz. No. 3, 1959, Abstract No. 5066.)

An experiment is described for the determination of the ratio e/m by the Busch method. The average, calculated from results of 60 measurements at 2800 to 4800 volts, is $e/m = (1.7599 - 0.0011) \times 10^7$ electromagnetic units. The error given (±0.06%) is the total probable error, determined with allowance for possible extraneous interfering effects. The value of the error of each individual measurement, which is 0.007% shows that the structural changes introduced compared with the hitherto used experimental setups resulted in the required observation accuracy of increase. The obtained value of e/m is in agreement, with the average values of other measurements by cathode rays, as well as with the value determined in measurements with nuclear resonance. Certain theoretical considerations led to corrections that have not been taken into account thus far. Depending on the dimensions of the apparatus, these corrections may amount from 0.1 to 0.3%.

22830

ON DIRECT FORMATION OF ELECTRON-POSITRON PAIRS BY HIGH ENERGY ELECTRONS. V. A. Tumanyan, G. S. Stolyarova, and A. P. Mishakova. Zhur. Eksptl'. i Teoret. Fiz. 37, 355-65(1959) Aug. (In Russian)

The absolute number of spurious tridents due to 10^{10}, 10^{11}, and 10^{12} ev primary electrons is computed by the Monte Carlo method for two types of bremsstrahlung spectrum: for that described by the Bethe-Heitler formula and that described by the Migdal formulas which take into account the Landau-Pomeranchuk and Ter-Mikaelyan effects. It is shown that it should be feasible to measure the energy of fast electrons by determining the energy dependence of the mean transverse distance between the vertexes of electron-positron pairs produced by bremsstrahlung γ quanta. The value computed by Bhabha for the cross section of direct formation of electron-positron pairs is confirmed experimentally. (auth)

22831

RECOIL NUCLEI PRODUCED IN THE DISINTEGRATION OF SILVER BY FAST PROTONS. N. I. Borisova, M. Ya. Kuznetsova, L. N. Kurchatova, V. N. Mekhedov, and L. V. Chistyakov (Joint Inst. of Nuclear Studies). Zhur. Eksptl'. i Teoret. Fiz. 37, 366-73(1959) Aug. (In Russian)

The angular and energy distribution of the Ag^{106}, $Ag^{103+104}$, Nb^{90}, Zr^{89}, Rb^{81+82}, and Se^{73} recoil nuclei produced in the disintergation of silver by 480-Mev protons is studied. Identification of the isotopes in the reaction product mixture was performed by radiochemical methods. The exponential nature of the energy distribution of the recoil nuclei was established and the distribution parameters at an angle of approximately 90° were derived. A qualitative explanation of the observed distribution is proposed. The results confirm the mechanism of Se^{73}, Rb^{81+82}, Zr^{89} and Nb^{90} formation by evaporation of α-particles, protons, and neutrons. (auth)

22832

POLARIZATION OF RECOIL PROTONS PRODUCED IN ELASTIC π^+—p-SCATTERING AT 307 Mev ENERGY. E. L. Grigor'ev and N. A. Mitin (Joint Inst. of Nuclear Studies). Zhur. Eksptl'. i Teoret. Fiz. 37, 413-21 (1959) Aug. (In Russian)

Results are presented of investigation on the polarization of recoil protons appearing in elastic $\pi^+ - p$ scattering through an angle of 140 ± 8° in the cms at an energy of 307 ± 5 Mev. A polarization value $P_1 = -0.19 \pm 0.17$ was derived from the data on the magnitude of the left-right asymmetry in elastic scattering of recoil protons on nuclei of the photographic emulsion. Phase shifts satisfying the indicated polarization value and consistent with the differential cross section for elastic scattering of π^+-mesons by protons are given. Problems connected with the use of various phase shift sets for analysis of the experimental data are discussed. (auth)

22833

ELECTROMAGNETIC INTERACTION IN HEISENBERG'S THEORY. Ya. I. Granovskiĭ (Inst. of Nuclear Physics,

Academy of Sciences, Kazakh SSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 442-51(1959) Aug. (In Russian)

Long range nucleon interaction is considered on basis of a nonlinear Lagrangian of the general form. The existence of forces possessing a Coulomb dependence on distance and a fine structure constant of 1/138 (scalar theory) is demonstrated with aid of the Heisenberg commutation function. The causes of absence of electromagnetic forces in the vector, tensor, and axial theories are considered. Deviations from the Coulomb law and their effect on renormalization of the charge are discussed. (auth)

22834

APPLICATION OF THE VARIATIONAL PRINCIPLE FOR DETERMINATION OF THE BINDING ENERGY OF A PROTON–ELECTRON–POSITRON SYSTEM. V. P. Shmelev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 458-66(1959) Aug. (In Russian)

The energy of a system consisting of the three particles, proton, electron, and positron, was determined by the variational method and found to be $E \leq 0.563$ Ry. The system can only dissociate into a proton and positronium atom, the dissociation energy being $|\epsilon| \geq 0.063$ Ry. (auth)

22835

ON THE POSSIBILITY OF DETERMINING THE π-MESON—π-MESON CHARGE EXCHANGE AMPLITUDE BY ANALYZING THE $\pi^- + p = N + \pi^+ + \pi^-$ REACTIONS NEAR THE THRESHOLD. A. A. Ansel'm and V. N. Gribov. Zhur. Eksptl'. i Teoret. Fiz. 37, 501-3(1959) Aug. (In Russian)

It is shown that an analysis of the experimental data on the energy distribution and angular correlations in the reactions $\pi^- + p \rightarrow n^+ + \pi^+ + \pi^-$, $n + \pi^0 + \pi^0$, $p + \pi^- + \pi^0$ permits one to determine the amplitude for charge exchange of charged π mesons involving their transformation into neutral ones: $\pi^+ + \pi^- \rightarrow 2\pi^0$. (auth)

22836

ON INTRODUCTION OF AN "ELEMENTARY LENGTH" IN THE RELATIVISTIC THEORY OF ELEMENTARY PARTICLES. Yu. A. Gol'fand (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 504-9(1959) Aug. (In Russian)

The pseudo-Euclidian momentum space is replaced in the theory by momentum space of constant curvature. The diagram technique of Feynman is generalized in the corresponding manner. Finite results are obtained in the lowest order perturbation theory approximation for the fermion and boson self-energy. (auth)

22837

POLARIZATION EFFECTS IN ELASTIC SCATTERING OF ELECTRONS ON DEUTERONS. G. V. Frolov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 522-6(1959) Aug. (In Russian)

The scattering differential cross section and the variation of electron polarization during elastic scattering of polarized electrons on polarized deuterons are calculated. (auth)

22838

TRANSITION EFFECT IN THE THEORY OF ENERGY LOSSES OF PARTICLES. G. M. Garibyan (Inst. of Physics, Academy of Sciences, Armenian SSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 527-33(1959) Aug. (In Russian)

Energy losses experienced by a particle passing through a layer of finite thickness are calculated. It is shown that the losses of high-energy particles due to traversa of a boundary between two media may be very significant. (auth)

22839

REMARKS ON THE SCHEME OF BARYONS. Kh. Yiglane (Inst. of Physics and Astronomy, Academy of Sciences, Estonian SSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 558-9 (1959) Aug. (In Russian)

The presented scheme of baryons describes all known baryon transformations and indicates no forbidden transitions. All weak interaction transitions can also change from a positive energy state to a negative and vice versa. This shows that process as of the $N + \bar{p} \rightarrow \beta^- + \nu$ type are possible, however with less probability than the probability of strong interaction processes. (R.V.J.)

22840

SPATIAL ASYMMETRY OF LOW ENERGY POSITRONS IN $\pi^+ - \mu^+ - e^+$ DECAY. A. O. Vaisenberg. Zhur. Eksptl'. i Teoret. Fiz. 37, 566-8(1959) Aug. (In Russian)

Studies were made of published data on the spatial distribution asymmetry of low-energy positrons in $\pi^+ - \mu^+ - e^+$ decays. Standard NIKFI–R emulsion was used for measuring the spectrum of 1102 particles at $a = 0.077$. The slow electron spectra contained 345 particles with the $\epsilon = 0.6$ energy at $a = 0.077$; the complete spectrum contained 565 positrons at $a = 0.28$. The data were used to determine the ratio of positrons emitted forward and backward $(\delta = N_f - N_b)/(N_f + N_b)$. The values of N_f and N_b in the energy ranges 0 to 0.3, 0.3 to 0.6, 0.6 to 0.8, 0.8 to 1.0, and > 1.0 and the excess of δ are plotted and tabulated. The asymmetry drops sharply at the transition from the edge of the spectrum to low energies and it is practically eliminated at $\epsilon <$ 0.5. (R.V.J.)

22841

THE NUMBER OF ELEMENTARY BARYONS AND UNIVERSAL BARYON REPULSION THEORY. Ya. B. Zel'dovich. Zhur. Eksptl'. i Teoret. Fiz. 37, 569-70 (1959) Aug. (In Russian)

The existence of an "imaginary" interaction, related to the idea that all baryons have an intrinsic common fermion which conserves the baryon charge, is considered. During interactions of similar particles, the short-acting interactions averaged by the states with various moments converge to zero. Studies of these short-acting forces between various particles with various spins and moments could replace the "imaginary" interaction for determining the number of elementary particles ν by means of the energy dependence on the density and could solve the problem of the existence of a common substructure in the various observed particle pairs. (R.V.J.)

22842

POLARIZATION EFFECTS IN DIRECT $\mu^+ - \mu^-$ CONVERSION INTO ELECTRON-POSITRON PAIR. B. A. Lysov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 571-2(1959) Aug. (In Russian)

The $\mu^+ - \mu^-$ pair conversion into an $e^- - e^+$ pair by means of virtual γ quantum was described by Yu. B. Zel'dovich (JETP, 36, 641, 1959). A detailed study is made of the described process extended to the nonrelativistic approximation. (R.V.J.)

22843

POLARIZATION EFFECTS IN $\pi^0 \rightarrow e^- + e^+ + \gamma$. B. K. Kerimov, A. I. Mukhtarov, and S. A. Gadzhiev (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 575-6 (1959) Aug. (In Russian)

Probabilities were calculated for π^0 meson decay

according the scheme $\pi^0 \rightarrow e^- + e^+ + \gamma$, considering the spin states (longitudinal polarization) of the produced electron-positron pair and γ quantum. (R.V.J.)

Heat Transfer and Fluid Flow

22844 AAEC/E-38

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
STUDIES OF SMALL PARTICLE SUSPENSIONS FOR L.M.F.R. PART VI. CONCENTRATION PROFILES ACROSS A BEND AND A VERTICAL PIPE. R. C. Cairns and K. R. Lawther. Sept. 1958. 19p.

Concentration profiles were measured for a tungsten suspension flowing through a smooth elbow and a vertical pipe. It is shown that uniform suspension at a smooth elbow is not achieved for velocities up to 13.8 ft/sec. Approximately four feet of vertical pipe is required after the smooth elbow to destroy the gradients set up in a horizontal pipe for velocities of approximately 3 and 13.5 per second. No evidence for "coring" was found. (auth)

22845 AECU-4305

Minnesota. Univ., Minneapolis. Inst. of Tech.
TWO-PHASE HEAT TRANSFER, TWO-PHASE BURNOUT. Final Report. Herbert S. Isbin. Aug. 26, 1959. 41p. Contract AT(11-1)-433. $7.80(ph), $3.30(mf) OTS.

A burnout model has been successfully applied to burnout heat flux data reported for the flow of steam–water mixtures in round tubes and channels with uniform and hot patch heating. The model requires the fitting of characteristic constants which can be evaluated from a set of burnout heat flux versus flow rate at a given subcooling and channel geometry. Two-phase local heat transfer coefficients were measured for steam–water flows up to pressures of 90 psia, maximum total flow rates of 182,000 lb/hr sq. ft., and heat fluxes up to 50,200 Btu/hr sq. ft in a horizontal ¼-in. brass pipe. The coefficients increased with increasing qualities up to qualities as high as 0.98. In the region of 0.98 to 1.00, the coefficients decreased to values approaching single phase runs. Brief notes are included on the extensive comparisons which have been made of the data with the literature and of other models proposed. (auth)

22846 BLG-37

Brussels. Centre d'Etude de l'Energie Nucléaire.
FROTTEMENT ET TRANSFERT DE CHALEUR DANS DES CHENAUX CARRES ET CIRCULAIRES CONTENANT DES TUBES LISSES ET DES TUBES MUNIS D'AILETTES. (Friction and Heat Transfer in Square and Circular Channels Containing Smooth Tubes and Finned Tubes.) P. Marien. June 1959. 358p.

Different methods for the study of heat transfer and friction in cylindrical tubes containing smooth or finned heated cores are presented. The characteristic heat transfer coefficient and the associated characteristic surface temperature are discussed. The experimental channel built to study the cooling of finned cans is described with emphasis on the electrical heating with graphite tubes and the technique for measurement of the surface temperature with a special thermoelectric gage. The hydraulic radius rule is generalized for the consideration of profiles having tangential contact between core and channel wall. The results are presented in dimensional groups which permits comparison of the friction and heat transfer obtained in tubes of widely different geometries. The results are compared with those obtained by previous workers. The importance of broken longitudinal fins is shown by the experimental results. (tr-auth)

22847 K-1435

Oak Ridge Gaseous Diffusion Plant, Tenn.
KNUDSEN FLOW THROUGH A CHANNEL WITH ROUGH WALLS. Wendell C. DeMarcus. Oct. 20, 1959. 10p. Contract W-7405-eng-26. $0.50(OTS).

A calculation is made of the Knudsen Flow through a short channel formed by two parallel walls which are roughened by a "roof top" structure on a fine scale. The molecular scattering is assumed to obey the cosine law with respect to the local roof normal. The effect of roughness is found to decrease the flow with respect to a smooth wall channel with cosine law scattering. (auth)

22848 LA-2301

Los Alamos Scientific Lab., N. Mex.
TWO-DIMENSIONAL HYDRODYNAMIC CALCULATIONS. Francis H. Harlow, Donald O. Dickman, David E. Harris, Jr., and Robert E. Martin. Apr. 1959. 96p. Contract W-7405-eng-36. $2.50(OTS).

Previous discussions of a computing method for solving two-dimensional hydrodynamic problems are amplified and extended. Results of computations are presented for problems involving shock diffraction and refraction, surface instabilities, and viscous flow. (auth)

22849 OOR-1256.10

Illinois. Univ., Urbana. Engineering Experiment Station.
EFFECT OF HEAT TRANSFER ON FLOW FIELD AT LOW REYNOLDS NUMBERS IN VERTICAL TUBES. Technical Report No. 8. Edward M. Rosen and Thomas J. Hanratty. Oct. 1959. 262p. Contract DA-11-022-ORD-1707.

Variation of density and viscosity with temperature may cause distortions in the flow field and affect the rate of heat transfer to fluids flowing in vertical tubes. For heating in upflow it was found experimentally that unstable flows exist at the inversion point, and for cooling unstable flows arise when the velocity gradient at the wall goes to zero. In order to predict the conditions under which inversion takes place, and under which the velocity gradient at the wall will go to zero, an approximate method of solving the equations of motion and energy simultaneously was developed. (auth)

22850 OOR-2275.1

Michigan. Univ., Ann Arbor and California. Univ., Berkeley. Inst. of Engineering Research.
THE ELASTIC-PLASTIC CYLINDER SUBJECTED TO RADIALLY DISTRIBUTED HEAT SOURCE, LATERAL PRESSURE, AND AXIAL FORCE WITH APPLICATION TO NUCLEAR REACTOR FUEL ELEMENTS. Technical Report No. 1. T. B. Kammash, S. A. Murch, and P. M. Naghdi. July 1959. 40p. Contracts DA-20-018-ORD-14447 and DA-04-200-ORD-171.

The elastic-plastic deformation of a solid cylinder in the presence of a distributed heat source and subjected to a lateral pressure p and an axial force F is considered. The general results are applied to the cylindrical nuclear reactor fuel element in the state of strain with a radially distributed Gaussian heat source, acting in its fissionable interior. The solution is expressed in closed form in terms of the exponential integral and the incomplete gamma function and is found to exhibit

three stages of plastic deformation. Throughout the deformation the states of stress are found to exhibit regular progression. (auth)

22851 WAPD-AD-TH-502

Westinghouse Electric Corp. Bettis Plant, Pittsburgh. NATURAL CIRCULATION TESTS WITH WATER IN RECTANGULAR CHANNELS AT 800 TO 2000 PSIA. O. J. Mendler and A. Weiss. Sept. 24, 1959. 47p. $7.80(ph), $3.30(mf) OTS.

No significant difference was noted between natural and forced circulation heating, local boiling, bulk boiling pressure drop, and departure from nucleate boiling. Pressure drop and departure from nucleate boiling data under forced circulation conditions are applicable to natural circulation systems. Present pressure drop relationship can be used to predict total pressure drops in uniformly heated test sections with channel spacings of 0.2 and 0.25 in. with an accuracy of 15% at 1200 and 1600 psia, departure from nucleate boiling appeared to occur at the same value of heat flux as has been measured for 0.097 in. thick channels, while at 2000 psia the two departure from nucleate boiling points obtained for the 0.2 and 0.25 in. thick channels occurred about 20 to 30% lower than those for the 0.097 in. thick channels, based on equivalent fluid conditions. (J.E.D.)

22852 AEC-tr-3850

COMPLETE CALCULATION OF HEAT EXCHANGE IN REGENERATORS. H. Hausen. Translated for Phillips Petroleum Co. from Z. Ver. deut. Ing., Verfahrenstech., No. 2, 31-43(1942). 31p. $6.30(ph), $3.00(mf) JCL.

A theory of the heat exchange in regenerators built mainly of brick-work developed earlier is extended so as to allow for rapid temperature changes immediately after reversal and for the difference in the temperature curves at the ends of the regenerator. The equations derived and the diagrams make possible exact calculation of regenerators even under extremely severe conditions and hold good even for the boundary cases of bricks of any thickness. (auth)

22853

THE THERMAL CONDUCTIVITIES OF MIXTURES OF RARE GASES AT 29°C AND AT 520°C. Hans von Ubisch (AB Atomenergi, Stockholm). Arkiv Fysik 16, 93-100(1959).

The thermal conductivities of all binary mixtures of the rare gases He, Ne, Ar, Kr, and Xe were measured at 29 and 520°C. Special emphasis is given the ternary mixtures of He, Kr, and Xe. (C.J.G.)

22854

THE EXPERIMENTAL DATA GENERALIZATION ON THE CRITICAL HEAT FLUXES IN FORCED FLOWING OF SUBHEATED WATER. B. A. Zenkevich. Atomnaya Energ. 6, 169-73(1959) Feb. (In Russian)

A theoretical simplification is postulated for the pressure equation previously developed for 100 to 210 atm. It is shown that the criterial equation can be used in a wider range of pressures (35 to 210 atm). Further development of experimental data on lower pressures confirmed the theoretical postulation on disintegration of functional bonds when pressure is close to atmospheric. In such an event the equation would have a considerably simplified appearance. A derived formula is recommended for the pressure range 1 to 15 atm. (tr-auth)

22855

THE HELICOIDAL MOVEMENT GROMECA–BELTRAMI OF AN IDEAL FLUID IN A CYLINDRICAL CIRCULAR PIPE. Stefan Zarea (Institut Politechnique, Bucharest). Bul. inst. politehnic Bucuresti 20, No. 2, 65-9(1958) Apr.-June. (In French)

The helicoidal uniform flow which satisfies the condition rot $\overline{V} = \alpha V$, where $\alpha = \alpha(x,y,z)$ is an arbitrary continuous function with first order derivatives, is studied for a circular cylindrical pipe. It is supposed that the α function is given by r. The distribution curve of the axial velocity thus obtained is analogous with the velocity curve in a turbulent motion. (auth)

22856

TO THE EXPERIMENTAL DETERMINATION OF THE CORRECTION TO THE HYDRODYNAMIC THEORY OF HEAT EXCHANGE FOR THE TURBULENT FLOW IN PIPES. L. A. Vvedenskaya. Sbornik Nauch. Trudov, Kuibyshev. Ind. Inst. im. V. V. Kuibyskeva, No. 6, Bk. 1, 225-7(1956). (Translated from Referat. Zhur. Mekhan., No. 8, 1957, p.71).

The correction term was determined in the equation of Prandtl's hydrodynamic analogy, $N = c_f R P \overline{K}/8$ (1), where N, R, and P are the Nusselt, Reynolds, and Prandtl numbers for the flow, respectively, and $\overline{K} = 1/[1 + w_2(P_m - 1)/w]$ (2), wherein the experimentally obtained relationships $N = 0.023\ R^{0.8}P^{0.4}$ (3) and $c = 0.3164/R^{0.25}$ (4) are employed. From equations (1), (3), and (4) it follows that $\overline{K} = 0.582R^{0.05}/P^{0.6}$ (5). Utilizing (2) and (5), the relationship $w_2/w = 1.72R^{-0.05}$ is derived (6) and recommended for the computation of the value of w_2/w. Here w is the fluid velocity in the core of a boiler, while w_2 is the velocity at the boundary of the laminar boundary layer.

22857

THE HEAT TRANSFER AND RESISTANCE OF TUBES DURING HIGH TEMPERATURE HEATING OF AIR. A. V. Arseyev. Teploenergetika 6, 67-72(1959).

An experimental study was made of heat transfer and resistance when heating air under the conditions met in high-temperature recuperators. Tests were made in heat-resistant steel tubes of 1 mm wall thickness. Clean dry compressed air was passed through the tubes. Details are given of the experimental rig and of the measurements that were made. Various corrections that were necessary are explained. Local heat-transfer and friction coefficients were calculated. The maximum relative error in determining heat transfer was ± (3 to 8) % and in determining the coefficient of friction ± (4 to 15) %, depending on the experimental conditions. Two sizes of tube were used, 14 and 22 mm internal diameter. When long tubes were used the air was heated to between 800 and 850°C, on reducing the length of the heated part of the tube, the air temperature fell to 700 and 600°C. The rate of flow of air by weight ranged from 14 to 144 kg/m^2 sec and the linear velocity from 3 to 190 m/sec. The hydraulic resistance under isothermal conditions was studied in the Reynolds number range of 17,000 to 175,000 and under heat exchange conditions from 7000 to 105,000. Heat transfer was studied in the Reynolds number range 7000 to 108,000. The heat transfer and resistance relationships were found to be the same for both sizes of tube and for different air pressures. Under isothermal conditions the tubes behaved as though smooth for Reynolds numbers below 30,000; the coefficient of friction then followed the well-known relationship for smooth tubes. For values of Reynolds number greater than 30,000 the coefficient of friction followed the law for rough tubes. However, in both regions the coefficient of friction for Reynolds

numbers between 17,000 and 175,000 may be calculated. Under heat-transfer conditions the coefficient of friction behaved just as under isothermal conditions, provided the Reynolds number is related to the flow temperature. If it is related to the wall temperature, the experimental points lie considerably lower. Under heat-exchange conditions the coefficient of friction may be calculated as for isothermal conditions, using a value of Reynolds number related to the wall temperature, but in this case a correction must be introduced for the temperature factor. The curves indicate that no single-valued simple relationship exists between the criteria of thermal and hydraulic similarity. It appears that heat transfer also depends on the temperature conditions, which may be allowed for by a temperature factor. The influence of the temperature factor is particularly marked when determining the Nusselt criterion from the wall temperature and the Re or Pe numbers from the flow temperature. The heat exchange relationship corresponds well for the relationship between the criteria of thermal and hydraulic similarity with allowance for the temperature factor. Values of the criteria of thermal similarity calculated from mean experimental data are in good agreement with the calculated curves of local heat-transfer. Thus the formulas are suitable for heat-transfer calculations on individual sections of the tubes and on tubes as a whole. The results are briefly compared with previously published data and are stated to be intermediate between them. A formula for the relationship between the criteria of thermal similarity is in comparatively good agreement with experimental data only over the Reynolds number range of 20,000 to 60,000. (TCO)

22858

ANALYTICAL CALCULATION OF THE ISOTHERMAL TEMPERATURE DIFFERENCE IN MULTIPLE-PASS HEAT EXCHANGERS. F. F. Zigmund. Trudy Kazan. Khim. Technol. Inst. im. S. M. Kirova, Nos. 19-20, 99-107(1955). (Translated from Referat. Zhur. Mekhan., No. 8, 1957, p.76).

The design temperature stress for multiple-pass heat exchangers was considered. The problem is reduced to the determination of a factor by means of which the available temperature stress may be utilized. Heat exchangers with parallel fluid flow, with multiple cross-flow circulation, and multi-pass battery type are examined. Calculation formulas are given for each case, and examples are adduced to illustrate the calculation procedure.

22859

BIBLIOGRAPHY ON THE MEASUREMENT OF GAS TEMPERATURE. National Bureau of Standards Circular 513. Paul D. Freeze. Washington D. C., National Bureau of Standards, 1951. 16p. $0.15(GPO)

A bibliography of approximately 400 references to articles on and related to the measurement of gas temperature, covering the 20 years prior to January 1951, are included. These references are grouped according to instrument types. (C.J.G.)

22860

A NEW ANALYTIC REPRESENTATION OF SURFACE INTERACTION FOR HYPERTHERMAL FREE-MOLECULE FLOW WITH APPLICATION TO SATELLITE DRAG. R. Schamberg (RAND Corp., Santa Monica, Calif.). p.1-14 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

The customary analytic representation of the gross effects of the interaction between gas molecules and a solid surface is re-examined and found to be unsatisfactory. An alternative model for surface interaction is proposed, and is used to calculate force coefficients of flat plate and convex bodies in "hyperthermal" free-molecule flow—the case for which the random thermal motion of the molecules is negligible relative to the speed of the body through the rarefied gas. Formulas are given for the drag coefficients of spherical, cylindrical, and conical satellites which may be either attitude stabilized or tumbling in a random manner. These formulas are then used to estimate the effects of uncertainty in the surface interaction on the drag of satellites. (auth)

22861

LOCAL HEAT TRANSFER, RECOVERY FACTOR, PRESSURE DISTRIBUTION AROUND A CIRCULAR CYLINDER NORMAL TO A RAREFIED SUPERSONIC AIR STREAM. O. K. Tewfik and W. H. Giedt (Univ. of California, Berkeley). p.15-26 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

Local heat transfer, recovery factor, and pressure distributions around a circular cylinder normal to a supersonic rarefied air stream were measured in the Mach range 1.3 to 5.9, the Reynolds number ranges 37 to 4100, and at two cylinder wall average temperature levels of 90 and 210°K, under steady state thermal and flow conditions. The experimental data are presented in tabular and graphical form. A correlation equation for the stagnation point Nusselt number was determined in terms of Reynolds number just after the normal part of the detached bow shock wave, or in terms of the undisturbed stream Mach and Reynolds numbers. Empirical expressions for the local heat transfer coefficient and coefficient of pressure distribution around the entire cylinder surface were obtained in the form of a Fourier series. Effects of cylinder wall temperature level and gradient on the heat transfer and pressure distributions are discussed. (auth)

22862

THE MAGNETOHYDRODYNAMICS OF A LAYER OF FLUID HAVING A FREE SURFACE. Coleman duP. Donaldson (Aeronautical Research Associates of Princeton, N. J.). p.55-67 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

The equations of motion for the behavior of a layer of conducting fluid having a free surface in the presence of a magnetic field are investigated. The propagation of surface waves is discussed and the phenomena compared with results from classical hydrodynamics. Steady flow problems for low magnetic Reynolds numbers and their relationship to the flows obtained on conventional water table analogues are discussed. In particular, the solution for the flow in a constant width channel which can be given in closed form is discussed in some detail. Examples of the flow through a magnetic weir and a modified hydraulic jump are presented. The electromagnetic acceleration of the fluid in such a constant width channel is discussed and the results compared with those of Resler and Sears for the acceleration of an ideal conducting gas. (auth)

22863

THE SUPPRESSION OF TURBULENCE IN PIPE FLOW OF MERCURY BY AN AXIAL MAGNETIC FIELD.

Samuel Globe (Avco Mfg. Corp., Wilmington, Mass.). p.68-79 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

An experimental investigation was made of the effect of an axial magnetic field on transition from laminar to turbulent flow and on the turbulent friction factor for pipe flow of mercury. Magnetic flux densities up to 5700 gauss were obtained with a water-cooled solenoid. Pipes of glass and aluminum were used of approximately 0.1 and 0.2" diameter. The maximum Hartmann number, with the hydraulic radius (half the actual radius) taken as the characteristic length, was about 20. Measurements were made of the pressure gradient and velocity of flow. The transition Reynolds number was determined from the curve of friction factor against Reynolds number. The results show an increasing value of minimum transition Reynolds number with Hartmann number, at the highest value of the Hartmann number the minimum transition Reynolds number was increased to about 1.8 times the value at zero magnetic field. The results can be correlated with an empirical modification of Stuart's stability theory for plane Poiseuille flow. The magnetic field also brought about a decrease in the turbulent friction factor and corresponding shear force at the wall. For Reynolds numbers just above transition the decrease in friction factor was about 30%. As the Reynolds number increased, the magnetic field brought about less of a decrease in the turbulent friction factor. For a Hartmann number of 20, there was no effect of the magnetic field above a Reynolds number of about 11,000. (auth)

22864

STAGNATION POINT HEAT TRANSFER IN A PARTIALLY IONIZED GAS. R. W. Rutowski (Lockheed Missile and Space Div., Sunnyvale, Calif.). p.110-25 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

The theory of stagnation point heat transfer to a hypervelocity blunt body satisfactorily predicts measured rates in air up to stagnation temperatures where the gas molecules are almost completely dissociated but where ionization is not yet significant. In the present experiment, interest centered on blunt body heat transfer in a gas with ionization present but without the complicating influences of molecular vibration and dissociation. A series of shock tube measurements made on a model in argon were evaluated and the results compared with values predicted by use of computed stagnation point properties under the assumption of equilibrium flow. Very good agreement was obtained for flows in which argon had not yet ionized but the experimental results are consistently higher for flows in which the gas was partially ionized. This discrepancy is evidently due to the effect of ionization on the transport properties. (auth)

22865

ENERGY TRANSFER IN THE COUETTE FLOW OF A RADIANT AND CHEMICALLY REACTING GAS. Robert Goulard and Madeleine Goulard (Purdue Univ., Lafayette, Ind.). p.126-39 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

The determination of the energy fluxes in a radiant medium requires the solution of a system of coupled conservation equations including the integro differential equation of radiant energy conservation. The resulting complexity may be avoided when radiation transfer is small compared to the usual molecular transport processes. For high temperatures, however, it becomes necessary to study the interaction of these processes in order to solve this system. For better understanding of this type of problem, the solution of the Couette flow in such a case is presented. It is found that the effect of the "long-range" process of radiation is to smooth out the temperature profiles and relieve the sharp temperature gradients at the cool wall. As a result, the application of this exact method yields a lower value of the total heat flux than calculated previously by approximate methods. (auth)

22866

VAPORIZATION OF A REFRACTORY OXIDE DURING HYPERSONIC FLIGHT. Sinclaire M. Scala (General Electric Co., Philadelphia). p.181-92 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

During flight through a hypersonic environment, the heat transfer to a vaporizing surface depends critically upon the aerothermochemical processes which occur in the boundary layer. The pertinent conservation equations on heat and mass transfer effects are presented and are employed in an analysis of the processes of diffusion, convection, and thermal exchange during the vaporization of a refractory material which reaches extremely high surface temperatures, such that reradiation must be considered at the surface. It is shown that the quantity Q^*, called the "effective heat of vaporization," which includes all heat absorbing or heat blocking effects, is an increasing function of stagnation enthalpy and a decreasing function of stagnation pressure, independent of body size, except where $\alpha\sqrt{R_s}$ and $\epsilon_w\sqrt{R_s}$ effects appear. The effects of vaporization rate-controlled mass loss applicable to high altitude flight are investigated and the relationship between the interphase mass transfer and the vaporization coefficient is established. The effects of non-equilibrium vaporization into a hypersonic laminar boundary layer are treated. (auth)

22867

DIFFUSION IN NEUTRAL AND IONIZED GASES WITH EXTREME PRESSURE GRADIENTS. Jack L. Kerrebrock (California Inst. of Tech., Pasadena). p.193-206 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

Two examples of diffusion in vortex flows are considered as simple cases of the more general problem of diffusion in flows with large pressure gradients normal to the principal flow direction. In the first, the two gases are assumed electrically neutral, and pressure and concentration diffusion are equally important. In the second, diffusion of the electrons of an ionized gas is studied. Diffusion due to electromagnetic body forces is of equal importance with pressure diffusion in this case, while concentration diffusion is negligible. It is found in the first example that the ratio of the radial mass flow of one species to the total radial mass flow is a characteristic value of the diffusion equation. The rates of diffusion are such that significant separation of the isotopes of uranium should be possible in vortices with supersonic tangential velocities. The radial pressure gradient leads to a radial electric field in the second example. A solution is obtained for the case of zero currents. By means of a perturbation technique, the solution is then extended to the case of small currents and induced fields. (auth)

22868
THE DECAYING PLASMA AS A METHOD OF HEATING A SUPERSONIC GAS STREAM. James C. Williams, III (Univ. of Southern California, Los Angeles). p.222-35 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

In the process of heating a supersonic gas stream by an electro-magnetic discharge much of the discharge energy enters the gas as potential energy of separation of ions and electrons or of atom-atom separation. As the excited gas decays back to the neutral state this potential energy reappears in the gas as directed kinetic and thermal energy, resulting in a continuously changing gasdynamic state. Specifically the decay of ionized nitrogen gas in a one-dimensional channel is considered. The equations of motion are presented and an approximate solution to these equations is shown. The general problem of heating in a supersonic stream is examined by the criteria of the entropy rise and total pressure decrease associated with supersonic heating. (auth)

22869
EXPERIMENTS ON A RADIO FREQUENCY DISCHARGE PLASMA IN SUPERSONIC FLOW. Raymond L. Chuan and Frederick O. Smetana (Univ. of Southern California, Los Angeles). p.236-43 of "1959 Heat Transfer and Fluid Mechanics Institute." Stanford, Calif., Stanford University Press, 1959. 250p.

Experiments were conducted with the view toward developing a radio frequency discharge for use as a heat source in low density, supersonic flows. The problems of providing a suitable electrode configuration which permits matching of the generator to the load and which provides for minimum stray radiation and high density power input were studied. The determination of an optimum length of time or distance during which the recombination processes would be sufficiently near completion and for which the physical length would not be unreasonable or the heat transfer to the walls self-defeating was studied. By permitting the decay processes to reach equilibrium, control of diffusion of free electrons with subsequent heat transfer to the wall is discussed. (auth)

Nuclear Properties and Reactions

22870 AD-162569
Westinghouse Electric Corp. Research Labs., Pittsburgh.
RESEARCH IN FAST NEUTRON SCATTERING AND OTHER FIELDS. Final Report [for] August 13, 1946 to April 30, 1958. Navy Report 67F597-R 14. B. Jennings. June 4, 1958. 27p. Contract N6(Ori)-156.

A bibliography containing 100 references on fast neutron scattering is presented. (W.L.H.)

22871 AECU-4316
Purdue Univ., Lafayette, Ind.
BETA-GAMMA ANGULAR CORRELATION MEASUREMENTS ON Au^{198}. I. DIRECTIONAL AND CIRCULAR POLARIZATION CORRELATION. Rolf M. Steffen. II. TRANSVERSE POLARIZATION OF THE BETA PARTICLES. P. C. Simms and Rolf M. Steffen. [1959]. 29p. Contract [AT(11-1)-122]. $4.80(ph), $2.70(mf) OTS.

The beta-gamma directional correlation of Au^{198} was measured as a function of the energy of the beta particles. The anisotropy factor $A_2(W)$ in the beta-gamma directional correlation $W_{\beta\gamma}(\theta,W) = 1 + A_2(W)\Gamma_2(\cos\theta)$ is proportional to p^2/W, and its value near the maximum beta energy is $A_2(2.8) = 0.029 \pm 0.001$. The beta directional gamma circular polarization correlation of Au^{198} was measured using the backscattering of the circularly polarized gamma radiation from a radially magnetized iron disk. The correlation is of the form: $W_{\beta\gamma pol}(\theta,W) = 1 + (0.45 \pm 0.07)\,(p/W)P_1(\cos\theta)$. The shape correction factor of the first-forbidden beta spectrum is independent of the beta energy above W = 1.6 within 5%. The analysis of the data shows that the ξ approximation for first-forbidden non-unique beta transitions represents the Au^{198} results in a very satisfactory manner. As a consequence of the nonconservation of parity in beta decay, beta particles emitted in first-forbidden beta transitions exhibit a small degree of polarization transverse to their momentum. The direction of the transverse polarization is defined with respect to a plane which is introduced by observing the direction of emission of the beta particle and the direction of omission of a gamma ray following the beta transition. The degree of the transverse polarization parallel to the beta-gamma plane $P_{T_{II}}$, and the degree of polarization perpendicular to the beta-gamma plane $P_{T\perp}$ has been measured for Au^{198}. The beta polarization has been detected by means of the left-right asymmetry in a Mott scattering process for an average electron energy W = 2.0 and for an angle $\theta = 135°$ between the beta momentum and the gamma direction. The results of the measurements, $P_{T_{II}} = +0.011 \pm 0.005$ and $P_{T\perp} = +0.03 \pm 0.008$, agree satisfactorily with the values calculated on the basis of the ξ-approximation from the anisotropy of the Au^{198} beta-gamma directional correlation. (auth)

22872 AECU-4340
Purdue Univ., Lafayette, Ind.
THE SELF-ABSORPTION CORRECTIONS AND COUNTING EFFICIENCIES OF CERTAIN FISSION PRODUCTS IN THE β-PROPORTIONAL COUNTER. Ray Gunnink and J. W. Cobble. Aug. 1959. 23p. Contract AT(11-1)-347. $4.80(ph), $2.70(mf) OTS.

The determination of absolute disintegration rates of carrier fission products continues to be an important radiochemical analysis. In much previous work Geiger counting was used, based either upon the absorption or upon 4π counting methods for absolute standardization. Of recent years the high geometry window proportional counter has had wide adoption. In general the higher counting efficiencies and stability of these "Sugarman" type counters is to be preferred, and it is demonstrated that for many isotopes the self-absorption corrections are made with a higher degree of accuracy. The isotopes used were standardized by $4\pi\beta$ and $4\pi\beta$–γ coincidence techniques. (W.D.M.)

22873 APEX-510
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
POLYNOMIAL APPROXIMATION OF GAMMA RAY BUILDUP FACTORS FOR A POINT ISOTROPIC SOURCE. M. A. Capo. Aug. 1959. 52p. Contracts AF33(600)-38062 and AT(11-1)-171. $1.50(OTS).

Polynomial expressions were derived for approximation of the gamma ray dose, energy, and energy absorption build-up factors tabulated for a point isotropic source in NYO-3075. The expressions represent the build-up factor as a function of gamma ray energy and the number of relaxation lengths for a specified material. Bivariant polynomial coefficients are presented in tabular form for water, aluminum, iron, tin, lead, tung-

sten, and uranium. In addition, coefficients are presented for approximation of build-up factors as a function of the number of relaxation lengths at specific energies. (auth)

22874 ARGMA-TR-1C32R
Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
GAMMA-GAMMA COINCIDENCE MEASUREMENTS OF Ba^{131}. (Cover carries title: THE DISINTEGRATION OF Ba^{131}). J. Richard Haskins. Aug. 1, 1959. 44p. Project TB2-0001.

The energies of the high-energy gamma rays in the decay of Ba^{131} were measured and found to be: 810 ± 10, 925 ± 10, and 1050 ± 15 kev, in agreement with a previous measurement. The existence of a 405-kev gamma ray in coincidence with the 214-kev gamma ray has been confirmed. It was determined that there are two gamma rays with energies of approximately 250 kev, one in coincidence with the 122-kev gamma ray and the other in coincidence with the 372-kev gamma ray. The 496 to 122 kev cascade was investigated. The K conversion coefficient for the 496-kev gamma ray was determined to be $(10.5 \pm 1.0) \times 10^{-3}$. The gamma-gamma angular correlation was found to be isotropic with both liquid and metallic barium sources. The K/L conversion ratio for the 122-kev gamma ray was determined to be 2.7 ± 0.5. These results are consistent with a 3/2 (M1) 1/2 (E2) 5/2 cascade or a 3/2 (M1 + E2) 5/2 (M1 + E2) 5/2 cascade with certain possible mixing ratios. Additional experiments are proposed, the results of which should make a decision between these two cases possible. (auth)

22875 CF-59-9-11
Oak Ridge National Lab., Tenn.
REACTION CROSS SECTIONS USING THE STATISTICAL MODEL OF THE COMPOUND NUCLEUS. S. K. Penny. Sept. 8, 1959. 13p. $3.30(ph), $2.40(mf) OTS.

The inelastic scattering of neutrons was considered by Hauser and Feshbach and a reaction cross section formula was obtained for the process. Competition from other processes was excluded from the formula since it was developed primarily for application to inelastic scattering of neutrons. The analysis presented is concerned with the minor changes involved when competition from other processes and the possibility of particles other than neutrons as incident and emergent particles are included. The presentation of these modifications of the cross section formula is through a derivation much like that of Hauser and Feshbach for the case in which the statistical model applies to the compound nucleus only. (auth)

22876 MLM-1093
Mound Lab., Miamisburg, Ohio.
HALF-LIFE OF RADIUM-223. H. W. Kirby, M. L. Curtis, and M. L. Salutsky. July 28, 1959. 12p. Contract AT-33-1-GEN-53. $3.30(ph), $2.40(mf) OTS.

The half life of Ra^{223} was found to be 11.412 ± 0.014 days. This value is significantly lower than the currently accepted half life (11.68 days) and definitely establishes that the latter is incorrect. However, because of certain discrepancies, the present half life is not considered definitive and a slightly lower value is not excluded. (auth)

22877 NAA-SR-Memo-3926(Rev.)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
RESONANCE CAPTURE FOR THE Th–U ALLOY FUEL. C. H. Skeen. July 9, 1959. 5p. $1.80(ph), $1.80(mf) OTS.

An exponential experiment was performed with a 5 × 5 square-celled lattice of 7-rod elements (¾" in diameter rods) spaced 9.5 inches apart in graphite. Data were taken from which it is possible to determine directly the probability, p, that epithermal neutrons escape capture in the fertile material (thorium) of the fuel while slowing down to the cadmium cut-off energy corresponding to 25 mil thick cadmium. The fuel was a Th–U^{235} alloy containing 7.6% uranium by weight. (auth)

22878 NEVIS-73
Columbia Univ., Irvington-on-Hudson, N. Y.
Nevis Cyclotron Labs.
THE INTERACTIONS OF 173 MEV NEGATIVE PIONS IN DEUTERIUM (thesis). Robert L. Bingham. Dec. 1958. 44p. Contracts N6-ori-110 and AT(30-1)-1932. $7.80(ph), $3.30(mf) OTS.

The Nevis 17 in. diffusion cloud chamber has been used to study the scattering of π^- mesons by deuterium. The beam energy is 173 ± 15 Mev in the laboratory system. The measured cross sections are: $\sigma(\pi^- + D \rightarrow \pi^- + D)$, 22 ± 4 mb; and $\sigma(\pi^- + D \rightarrow \pi^- + N + P)$, 127 ± 11 mb. Estimates of the cross sections for the remaining processes indicate that the total π^- + D cross section is about 200 mb. Differential cross sections for these two processes are given and found to be qualitatively like those predicted by the impulse approximation, although much lower in magnitude. Due to the limitation of the experimental technique, no measurement of the elastic cross section at zero degrees was possible, although the use of the optical theorem predicts $d\sigma^E/d\Omega\ (0^\circ) = 52$ mb/ster. This implies a steep rise in the elastic scattering cross section in the extreme forward angles which makes a direct comparison with the results of the dispersion theory treatment impossible in the present experiment. (auth)

22879 TNCC(Can)-21
Atomic Energy of Canada Ltd., Chalk River, Ont.
EPITHERMAL EFFECTS ON FISSION PRODUCT CROSS SECTIONS. W. H. Walker. Sept. 1959. 12p. (AECL-874). $0.50(AECL).

The purpose of this work is to make a quantitative estimate of the effect of absorption in the resonance region in a thermal reactor on the effective cross section of fission products. Results are given of calculations of resonance absorption integrals of fission products for which parameters are available. In presenting the results of epithermal effect calculations no comparisons are made with earlier computed values, but measured values are included. (W.L.H.)

22880 UCRL-3230
California. Univ., Berkeley. Radiation Lab.
BREMSSTRAHLUNG FROM PROTON BOMBARDMENT OF NUCLEI. David Cohen. Dec. 1955. 74p. Contract W-7405-eng-48. $12.30(ph), $4.50(mf) OTS.

Various targets were bombarded with protons in the 40 to 140 Mev region, and the gamma spectra were detected and analyzed. Under the assumption that the gamma rays originated from the deflected protons, the purpose of the experiment was to obtain information about the nature of the nuclear interactions through which the protons suffered changes of states. Targets of Cu, Al, C, and Be were placed in the synchrocyclotron and viewed with a pair spectrometer. (W.D.M.)

22881 UCRL-8785

California. Univ., Berkeley. Lawrence Radiation Lab.
ANTIPROTON INTERACTIONS IN HYDROGEN AND CARBON BELOW 200 Mev (thesis). Lewis E. Agnew, Jr. July 23, 1959. 91p. Contract W-7405-eng-48. $2.50(OTS).

About 500 antiprotons in a partially purified beam were observed to enter the 30-in. propane bubble chamber. An arrangement of time-of-flight scintillation counters and a velocity-selecting counter enabled electronic identification of antiproton events, thus reducing scanning to a minimum and also providing a sample of antiprotons free of scanning bias. The antiprotons entered the propane at a kinetic energy of 220 Mev and were brought to rest. Scattering and annihilation interactions in both hydrogen and carbon were observed vs. antiproton energy. Differential scattering cross sections were obtained, and the total cross sections were measured for antiproton kinetic energies in the ranges 75 to 137.5 Mev and 137.5 to 200 Mev. (auth)

22882 WADC-TR-59-31

Texas Nuclear Corp., Austin, Tex.
INTERACTION OF FAST NEUTRONS IN IRON, LEAD, OXYGEN, AND NITROGEN. [Period covered] April 15, 1957–January 31, 1959. Norman A. Bostrom, Ira L. Morgan, J. Thomas Prod'homme, Pablo L. Okhuysen, and O. M. Hudson, Jr. Feb. 1959. 144p. Projects No. 7112 and 7-(8-7360). Contract AF33(616)-5111. (AD-216652).

An investigation of the interaction of fast neutrons in N, O, Fe, Ni, and Pb was made for various energies. In particular the following measurements were made: the angular distributions of the neutrons inelastically scattered from Fe and Pb for 3.67, 4.21, and 4.70 Mev neutrons, using a pulsed beam time-of-flight spectrometer; the angular distributions of the neutrons non-elastically emitted by Fe and Pb due to the bombardment of these elements with 15.2 Mev neutrons; the energy distributions of the neutrons scattered at 90° from Fe and Pb for 4.21 Mev neutrons; the energy distributions of the neutrons emitted at 90° by Fe and Pb resulting from bombardment with 15.2 Mev neutrons; cross sections for the production of gamma rays emitted from Fe, Pb, N, and O due to neutron interactions in the energy region from 3.2 to 4.6 Mev and at 1.0, 7.5, and 14.9 Mev; the angular distribution of the 0.845 Mev gamma ray from Fe which results from inelastic neutron scattering at E_n = 1.0 and 4.70 Mev; the angular distribution of the 2.62 Mev gamma ray from Pb at E_n = 4.18 Mev in the angular range from 50 to 90°; the angular distribution of the gross gamma rays from Fe and Pb for incident neutron energies of 3.67, 4.21, and 4.70 Mev; the angular distributions of the neutrons elastically scattered from Fe and Pb for 3.67, 4.21, and 4.70 Mev neutrons; the activation cross section of Ni for thermal neutrons; and the cross section for the production of high energy gamma rays due to capture in Ni for neutrons in the energy range from 100 to 500 kev. (auth)

22883 WASH-1021

Nuclear Cross Sections Advisory Group, AEC.
REPORTS TO THE AEC NUCLEAR CROSS SECTIONS ADVISORY GROUP, BROOKHAVEN NATIONAL LABORATORY, UPTON, N. Y., JUNE 22-23, 1959. Vance L. Sailor. 65p. $2.00(OTS).

The cross section measurement programs at ANL, BNL, Columbia U., Duke, HAPO, LASL, ORNL, Phillips, RPI, Rice, and UCRL are reviewed. An informal statement of recent developments, changes of emphasis, and preliminary data which are of importance to the cross section measurement program of the AEC are included. (W.D.M.)

22884 CEA-tr-R-725

COMPARAISON DES SPECTRES DES NEUTRONS DE FISSION. (Comparison of the Fission Neutron Spectra of U^{233}, U^{235}, and Pu^{239}.) V. P. Kovalev, V. N. Andreev, M. N. Nikolaev, and A. G. Guseinov (Gousseinov). Translated into French by B. de Trezvinsky from Zhur. Eksptl'. i Teoret. Fiz. 33, 1069-70(1957). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 3864.

22885

NATURAL FREQUENCIES OF A COMPRESSED NUCLEUS IN THE NON-STATIC STATISTICAL MODEL. I. Brandus and A. Sandulescu. Acad. rep. populare Romîne, Inst. Fiz., Studii cercetări fiz. 8, 433-44(1958). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 5134.)

The non-static consideration in the statistical model, developed first by Bloch (Bloch, F. Z., Phys. 1933, 81, 363) and supplemented by Jensen (Jensen, H. Z., Phys. 1937, 106, 620) for the atom, is extended to include a compressible nucleus. Only such excitations are investigated, which do not produce thermal motion in the nucleus, and which do not contribute to an ordered hydrodynamic motion. The change in density in the nuclear liquid arising in this case is considered as a small perturbation. The equation for the perturbation in the density is derived from the least-action principle under the condition that the ratio of the number of neutrons to the number of protons in the nucleus is constant. An analytic solution of the equation obtained is possible only in the case, when the density of the nucleons in the unexcited nucleus is considered constant. The natural frequencies of monochromatic density oscillations are found from the boundary condition, according to which the internal pressure of the nuclear liquid can be balanced by the pressure produced by surface tension. The results are in qualitative agreement with the experimental data.

22886

NOTE ON THE $^{12}C(d,p)^{13}D$ REACTION NEAR THE 4 Mev RESONANCE. J. Dabroski and B. Lulczyjew (Univ. of Warsaw). Acta Phys. Polon. 16, No. 3, 231-4 (1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 15150.)

The differential cross section of the reaction $C^{12}(d,p)C^{13}$ near resonance at 4 Mev was calculated. No account was taken in the calculation of the Coulomb scattering and of the potential scattering. It was assumed that the particles participating in the formation of the compound nucleus have the following values of momenta: $\gamma_d = 2$, $j_p = 1$, and $\gamma_n = 1$. The possible contribution of the momenta $l_d = 4$ and $j_p = 1$ were not taken into account. The total momenta $J = 3^+$ and the width $\Gamma = 0.5$ Mev were attributed to the excited level of the compound nucleus. The calculation was made in the Born and Butler approximation. The results obtained are compared with experimental data. It is noted that the assumption of the formation of the compound nucleus is not enough to explain the strong backward scattering of the protons, which is observed experimentally.

22887

CHARGE DISTRIBUTIONS OF NUCLEI OF THE 1p

SHELL. Ulrich Meyer-Berkhout (Stanford Univ., Calif.) and Kenneth W. Ford and Alex E. S. Green (Los Alamos Scientific Lab., N. Mex.). Ann. Phys. (N. Y.) 8, 119-71 (1959) Sept.

Data are reported at energies of 160 to 420 Mev for the scattering of electrons by Be^9, B^{10}, B^{11}, N^{14}, and O^{16}. A detailed analysis of these elastic scattering data and other available data for p-shell nuclei is carried through, using various methods and a wide variety of assumed functional forms of the nuclear charge distribution. It is possible to fix rather accurately the spherically symmetric part of the charge distributions of Li^6, C^{12}, N^{14}, and O^{16}, and with less accuracy, those of Be^9 and B^{11}. Central densities are uncertain in all cases. Quadrupole scattering appears to be important in N^{14}, in B^{11}, and possibly in Be^9, and a crude estimate of the quadrupole moment of N^{14} is inferred from the data. The quadrupole scattering depends sensitively on the source of the quadrupole moment, as well as on its value. Regularities within the p-shell are discussed, and connection made with the properties of heavier nuclei. Be^9 and all heavier nuclei have a common value of peak particle density corresponding to a mean particle spacing of $(1.13 \pm 0.01) \times 10^{-13}$ cm. Only Li^6 fails to reach this density of saturated nuclear matter. (auth)

22888

ON THE ALPHA DECAY OF STRONGLY DEFORMED ODD-A NUCLEI. Owe Prior (Univ. of Lund, Sweden). Arkiv Fysik 16, 15-18(1959).

The hindrance factor is correlated with changes in the so-called asymptotic quantum numbers characterizing the single particle orbitals of deformed nuclei for neptunium through californium. With $F \sim 1$ to 4, α-transitions are favored in most cases. (C.J.G.)

22889

THE RADIOCHEMICAL STUDY OF PION PRODUCTION NUCLEAR REACTIONS. A. K. Lavrukhina, I. M. Grechishjeva, and B. A. Hotin. Atomnaya Energ. 6, 145-51(1959) (In Russian)

Studies of (p,π^+) and $(p,p\pi^+)$ reactions on nuclei of mean atomic weight elements show that at proton energies of 480 to 660 Mev their cross section is equal to $\sim 10^{-30}$ cm^2/nucleon. A considerable increase in the cross sections was observed in the energy range 110 to 480 Mev. The products of the $(p,2\pi^+)$ reaction on copper could not be identified, neither could the reaction be observed with heavy elements. The reaction (p,π^+) with complex nucleons is discussed. The obtained data offer a clearer concept of processes taking place in high-energy particle interactions with complex nuclei. (tr-auth)

22890

NEUTRON SCATTERING IN PARA AND ORTHOHYDROGEN. E. A. Chistova and S. I. Drosdov. Attomnaya Energ. 6, 152-61(1959). (In Russian)

Characteristics of neutron scattering in hydrogen, important in calculations of slow neutron spectra in attenuating media, are estimated. Functions are derived for the dependence of the total cross section in para- and ortho-hydrogen gas on the neutron energy and temperature. Computer data are presented in tables and graphs. The energy above the gas temperature was studied and excitations of rotational levels and zero nuclear vibrations in molecules are considered. (tr-auth)

22891

DIFFERENTIAL SCATTERING CROSS-SECTION OF ATOMS TO MEDIUM ENERGY ELECTRONS AT SMALL ANGLES. M. E. Haine and A. W. Agar (Associated Electrical Industries Ltd., Aldermaston, Berks, Eng.). Brit. J. Appl. Phys. 10, 341-7(1959) Aug.

The differential scattering cross section of carbon, copper, gold, silver, and aluminum were determined by experiments in an unmodified electron microscope for angles between 10^{-2} and 10^{-3} rad. The results were in reasonable agreement with the Lenz theory. The cross section appears to be independent of the atomic number of the scattering material and inversely proportional to the accelerating voltage, a dependence of cross section for film thickness less than the transparency thickness in the case of carbon is not explained. (C.J.G.)

22892

RADON NEUTRON SOURCES. M. A. Bak, G. V. Gorshkov, V. I. Matviyenko, K. A. Petrzhak, and Yu. F. Romanov (Radium Inst., Academy of Sciences, Leningrad). Bul. inst. politeh. Iasi 3, 47-54(1957). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 7481).

By measuring the spatial distribution of the neutron density in H_2O, the power and the average energy of the neutron sources Rn-Be, Rn-B, Rn-C, Rn-CaF_2, Rn-Mg, Rn-Al, and Rn-Si (the α,n reaction) were determined. The absolute neutron yield from the various sources was determined by comparing the integral distributions of the slowed-down neutrons from the investigated and from a standard Ra-Be source. The mean energy of the neutron spectra was estimated from the magnitude of the relaxation length (L), determined from the measurements of the distribution of the density of the neutrons at distances greater than 20 cm ($\sim e^{-x/L}$). The neutron yield varies from 1.5×10^{-4}/microcurie of Rn for Be to 37/microcurie of Rn for C. The average energy of the spectra of the investigated sources lies in the interval from 2.0 to 4.7 Mev. The relaxation length depends linearly on the maximum energy of the neutron spectra.

22893

DETERMINATION OF THE EXCITED LEVELS OF CARBON NUCLEI BETWEEN 18 AND 21 Mev FROM THE PHOTONEUTRON REACTION. Dror Sadeh. Compt. rend. 249, 531-3(1959) July 27. (In French)

An activation curve for the reaction $C^{12}(\gamma,n)C^{11}$ was obtained using a 31-Mev betatron. The slope of this curve has discontinuities (or "breaks") which show that the photons can be absorbed by narrow resonances corresponding to excited levels of the initial nucleus or the final nucleus. Discontinuities were found at 18.86, 18.96, 19.10, 19.31, 19.56, 19.95, 20.37, and 20.75 Mev. (J.S.R.)

22894

CALCULATION OF THE MAGNETIC RESONANCE IN THE GROUND STATE OF ODD ISOTOPES OF MERCURY IN THE PRESENCE OF AN ORIENTING LUMINESCENT IRRADIATION. Bernard Cagnac and Jean-Pierre Barrat. Compt. rend. 249, 534-6(1959) July 27. (In French)

A theoretical interpretation of the experimental data on nuclear orientation, magnetic moments, and nuclear relaxation of Hg^{199} and Hg^{201} is obtained by adding to the Hamiltonian of the rotating field the imaginary term $-i\hbar/2T_m$. (J.S.R.)

22895

SOME EFFECTS OF FAST NEUTRON IRRADIATION ON CARRIER LIFETIMES IN SILICON. R. W. Beck,

E. Paskell, and C. S. Peet (Battelle Memorial Inst., Columbus, Ohio). J. Appl. Phys. 30, 1437-9(1959) Sept.

Single crystal specimens of silicon were exposed to fast neutrons from a reactor source to determine the room temperature effects of irradiation on carrier lifetimes. For highly n- and p-type material the approximate lifetime damage constants, defined as $1/\tau = 1/\tau_1 + \alpha\phi$, are found to be $\alpha_n = 4.4 \times 10^{-7}(\text{nvt})^{-1} \times (\text{sec})^{-1}$ and $\alpha_p = 1.2 \times 10^{-6}(\text{nvt})^{-1}(\text{sec})^{-1}$. Two possible positions of the dominant recombination level are 0.36 ev below the conduction band or 0.33 ev above the valence band. Further agreement with the value of α_p was obtained by measuring high level lifetime in silicon junction diodes. (auth)

22896

ALPHA EXCITATION FUNCTIONS OF IRON-54. Shigeo Tanaka, Michiaki Furukawa, Masuo Yagi, Shiro Iwata, and Hiroshi Amano (Univ. of Tokyo). J. Phys. Soc. Japan 14, 1251(1959) Sept.

Excitation functions of the $Fe^{54}(\alpha,n)Ni^{57}$, $Fe^{54}(\alpha,p)Co^{57}$, $Fe^{54}(\alpha,2n)Ni^{56}$, and $Fe^{54}(\alpha,pn)Co^{56}$ reactions were measured by the activation methods at 32 Mev. (C.J.G.)

22897

DISTRIBUTION OF PROTONS AND NEUTRONS IN HEAVY NUCLEI. Erzsebet Rupp. Magyar Fiz. Folyóirat 5, No. 3, 183-6(1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 15060.)

An investigation was made of the distribution of nucleus in nuclei on the basis of the shell model. The density of the nucleons is determined with the aid of the Hartree method. The interacting forces were chosen to be of the Yukawa type. Specific calculations were carried out for a nucleus with A = 160 and Z = 64. The following values were obtained for the radius of distribution of the neutrons and protons: $R_n = 1.40 \times 10^{-13}$ A $cm^{\frac{1}{3}}$, $R_p/R_n = 0.960$.

22898

CROSS SECTION OF NUCLEAR REACTION $I^{127}(\gamma,n)I^{126}$. Janos Ero and Lajos Diszthelyi. Magyar Fiz. Folyóirat 5, No. 4, 301-10(1957). (Translated from Referat. Zhur. Fiz. No. 7, 1958, Abstract No. 15121.)

The crystal NaI(Tl) was exposed to gamma obtained as a result of the Li(t,γ) reactions. By measuring the activity of the I^{126} nucleus formed in the irradiated crystal, and also by counting the number of scintillations occurring, the cross section of the reaction $I^{127}(\gamma,n)I^{126}$ was determined to be 125 ± 6 mbarns. By comparing the results obtained with the data on the neutron yield, the cross section of the reaction (γ,2n) was determined to be 30 ± 20 mbarns. The ratio of the intensity of K capture by the I^{126} nucleus to the remaining forms of the decay is 0.51 ± 0.03.

22899

INVESTIGATION OF THE NUCLEAR REACTION $B^{10}(n,\alpha)Li^7$ BY THE PHOTOEMULSION METHOD. Erno Bujdoso (MTA, Atommag Kutato Intezete, Debrecen, Hungary). Magyar Fiz. Folyóirat 6, No. 2, 143-51(1958). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 5209.)

An Agfa nuclear emulsion (K3), filled with boron, was irradiated with slow neutrons. By measurement of the ranges R (α + Li^7) the energy of the reaction for cases of formation of a Li^7 nucleus in the ground and excited states was measured. Values of 2.76 ± 0.17 and 2.29 ± 0.09 Mev respectively were obtained. The ratio of the probabilities of formation of a Li^7 nucleus in the ground and excited states is $\sigma[B^{10}(n,\alpha)Li^7]/\sigma[B^{10}(n,\alpha)Li^{7*}] = 0,086 \pm 0.009$.

22900

THE (γ,p) REACTION ON POTASSIUM. Janos Ero and Lajos Keszthelyi. Magyar Tudomanyos Akad. Központi Fiz. Kutató Intézetének Közlemenyei 5, 428-35(1957). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 5203.)

A thin crystal of KI is exposed to γ rays from Li with energies of 17.6 Mev. The energy spectrum of the protons obtained as a result of the reaction $K^{39}(\gamma,p)A^{38}$ was measured. The resultant spectrum deviates considerably in the high energy portion from that expected by statistical theory.

22901

REMARKS ON EXICTED LEVELS OF Pt^{192}. Lajos Keszthelyi and Joszef Zimanyi. Magyar Tudományos Akad. Kösponti Fiz. Kutató Intézetének Közlemenyei 5, 495-501(1957). (Translated from Referat. Zhur. Fiz. No. 1, 1959, Abstract No. 436).

The Pt^{192} nuclide goes from an excited state with energy 784 kev partially into the 316-kev state by emission of radiation (E2) with energy 468 kev, and partially into the ground state by emission of 784-kev radiation (E4). Starting from the greater intensity of the transition into the ground state, the time of the E2 transition should be on the order of 10^{-6} seconds. On the basis of the beta-gamma coincidences, the 468-kev transition time is less than 2×10^{-9} seconds. Measurement of the high-energy portion of the spectrum of Pt^{192} with the aid of a scintillation spectrometer has shown that the relative intensity of the 784-kev line is less than 0.5×10^{-2} (in units of the intensity of the 600-kev line). Measurements by the coincidence method reveal that the relative intensity of this line can be approximately three orders of magnitude less. Measurements confirm the existence of the 1050 and 1210 kev lines.

22902

DIRECT DETERMINATION OF THE HALF-LIVES OF NINE NUCLIDES. J. Paul Cali and L. F. Lowe (Cambridge Research Center, Bedford, Mass.). Nucleonics 17, No. 10, 86-8(1959) Oct.

The half lives of S^{35}, Ca^{45}, Ru^{103}, Ag^{110m}, In^{114m}, Sb^{124}, Pm^{147}, Hf^{181}, and Hg^{203} were determined by direct measurement after extensive radiochemical purification. These new values are compared to previous determinations. After irradiation and purification the isotopes were mounted on aluminum planchets with collodion-ether. After ether evaporation a film of rubber hydrochloride was placed over the planchet and the assembly was dried under vacuum. The samples were counted in a modified methane-flow proportional counter with a 200-volt plateau at 4,600 v. The window was a Mylar film with approximately 2π geometry. Samples were counted periodically to a total of 2^{16} counts per sample. (C.J.G.)

22903

SOME INVESTIGATIONS ON THE FORMAL THEORY OF SCATTERING. Tse-sen Yang. Pei Ching Ta Hsüeh Hsüeh Pao—Tza Jan K'o Hsüeh 4, 293-303(1958). (From Sci. Abstr. China; Mathematical and Phys. Sci. No. 2, 1958, Abstract No. 127.)

A dynamical system of the following type is discussed: The total Hamiltonian H is separated into two parts H_0 and V, H_0 possesses the same continuous spectrum as that of H, but H possesses in addition a discrete spectrum corresponding to bound states. It is shown that the

solution in the interaction representation of the time dependent Schrödinger equation with initial condition specified at $t=\pm\infty$ is not unique. It contains a unique scattering-state part but an arbitrary bound-state part. The former part is a physical solution and can be obtained directly by operating $U(t,\pm\infty)$ on initial state $\phi(\pm\infty)$, where $U(t,\pm\infty)$ is defined as $\lim_{t_0\to\pm\infty} U(t,t_0)$. This solution may be used as the starting point of formal scattering theory. In addition, some points in the earlier works of Lippmann-Schwinger, Coester, and Arnous-Zienau are discussed and clarified. (auth)

22904

CROSS SECTIONS FOR ELASTIC SCATTERING AND REACTIONS DUE TO PROTONS ON N^{15}. S. Bashkin, R. R. Carlson, and R. A. Douglas (State Univ. of Iowa, Iowa City). Phys. Rev. 114, 1543-51(1959) June 15.

Absolute differential cross sections were measured for the reactions $N^{15}(p,p)N^{15}$, $N^{15}(p,\alpha_0)C^{12}$ (ground state), and $N^{15}(p,\alpha_1)C^{12*}$ (first excited state). Thin gas targets, enriched up to 98% in N^{15}, and a 6-mil CsI(Tl) crystal detector were used. Numerous angles were studied for bombarding energies between 1 Mev and 3.6 Mev. Spins and parities are discussed where resonances suggest the existence of excited states in O^{16}. At the 1210 kev resonance, the incident energy for which the α_0 yield is maximum depends on the angle of observation. This is probably the result of interference and has bearing on the spin and parity assignment of this level. The anomaly at 1890 kev cannot be positively identified as due to resonance. (auth)

22905

CROSS SECTION FOR ELASTIC SCATTERING OF PROTONS BY N^{14}. S. Bashkin, R. R. Carlson, and R. A. Douglas (State Univ. of Iowa, Iowa City). Phys. Rev. 114, 1552-3(1959) June 15.

The elastic scattering cross section for protons on N^{14} was measured for bombarding energies from 900 to 4000 kev and for angles of 90, 125.3, 149.4, and 160.9° in the center-of-mass system. A gas target chamber and a 6-mil thick CsI(Tl) crystal detector were used. The cross section was measured to an absolute accuracy of ±3.5%. An anomaly was observed at 3880 ± 40 kev corresponding to a state in O^{15} at 11.00 Mev previously seen in the yield of gamma rays in the $N^{14}(p,p'\gamma)N^{14}$ reaction. (auth)

22906

DECAY OF Co^{56} AND Mn^{56}. P. Kienle (Brookhaven National Lab., Upton, N. Y.) and R. E. Segel (Aeronautical Research Lab., Dayton, Ohio). Phys. Rev. 114, 1554-60(1959) June 15.

Scintillation spectroscopy and coincidence techniques were used to measure the decay schemes of Mn^{56} and Co^{56}, both of which decay to Fe^{56}. Gamma-ray energies and intensities were measured with the aid of a large NaI(Tl) crystal and a three-crystal pair spectrometer. Combining these data with γ-γ and β-γ coincidence measurements, decay schemes are constructed for both nuclei. The log ft values for the various β branches are examined and all of the β branches from Co^{56} show higher than usual log ft values for allowed transitions. The Co^{56} decay to the second excited state in Fe^{56} is inhibited by a factor of $\sim 10^2$ while the Mn^{56} decay to the same state is inhibited even further. The allowed Mn^{56} decay to the first excited state in Fe^{56} is also slowed, while Mn^{56} decays to higher states proceed at more normal speeds. A discussion of the β-transition rates in terms of shell model assignments is given, from which some explanation of the β rates results. The high inhibitions of the decays to the second excited state in Fe^{56} do not seem susceptible to a simple shell-model explanation. (auth)

22907

NEUTRON-PROTON CAPTURE CROSS SECTION. Robert W. Stooksberry and Marshall F. Crouch (Case Inst. of Tech., Cleveland). Phys. Rev. 114, 1561-3 (1959) June 15.

The mean lifetime of thermal neutrons in water is measured with a large moderator (radius ~7 diffusion lengths), for which the correction for escape is only about 5%. The geometry is such that the perturbing effect of the immersed BF_3 neutron detector can be almost rigorously calculated. The value obtained is $\tau = 206.3 \pm 5.0$ μsec, giving the neutron-proton capture cross section as $(0.330 \pm 0.008) \times 10^{-24}$ cm^2. A possible systematic error from higher modes in the neutron distribution is discussed. (auth)

22908

ELASTIC SCATTERING OF 3.7-Mev NEUTRONS FROM S, Fe, Co, Ni, Cu, AND Zn. M. K. Machwe, D. W. Kent, Jr., and S. C. Snowden (Barton Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 114, 1563-70(1959) June 15.

The differential cross sections for the elastic scattering of 3.7-Mev neutrons from sulfur, iron, cobalt, nickel, copper, and zinc were measured in a ring geometry using a modified Bonner-type scintillation detector. The measurements were taken over an angular range between 10 and 160°. Angular resolution effects were removed by a suitable iterative procedure. Multiple-scattering effects were removed by an approximate analytical treatment. (auth)

22909

EXPERIMENTAL DETERMINATION OF THE NON-MAGNETIC NEUTRON-ELECTRON INTERACTION. E. Melkonian, B. M. Rustad, and W. W. Havens, Jr. (Columbia Univ., New York and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 114, 1571-6(1959) June 15.

A precise set of measurements of the variation of the transmission of liquid bismuth with energy in the range 0.1 to 10 ev was made. After correction for neutron capture, Doppler effect, and liquid diffraction, a value of $V_0 = -4.34 \pm 0.14$ kev is obtained as the depth of the potential well having a radius equal to the classical electron radius. This gives -0.26 ± 0.14 kev as the strength of the intrinsic neutron-electron interaction after subtraction of the Foldy term. (auth)

22910

SLOW-NEUTRON RESONANCES IN Eu^{151} AND Eu^{153}. Fahri Domanic and Eugene T. Patronis, Jr. (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 114, 1577-80 (1959) June 15.

The total neutron cross sections of Eu^{151} and Eu^{153} were measured between 1 and 10 ev using a high-resolution crystal spectrometer. The Breit-Wigner parameters were obtained for the 1.055, 2.717, 3.368, and 3.710-ev resonances in Eu^{151}, and for the 1.725, 2.456, 3.294, 3.944, 6.16, and 8.87-ev resonances in Eu^{153}. The values of the radiation widths for the 1.055, 2.717, 3.368, and 3.710-ev resonance in Eu^{151} are higher. (auth)

22911

$Li^6(n,t)He^4$ REACTION AT INTERMEDIATE ENERGIES. S. J. Bame, Jr. and R. L. Cubitt (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 114, 1580-3(1959) June 15.

The $Li^6(n,t)He^4$ reaction cross section was measured in a neutron energy interval extending from 9 to 340 kev. The cross section descends from 1.77 barns at 9 kev to a minimum of 0.74 barns at 100 kev before rising to a peak resonance value of 2.75 barns at 258 kev. The cross section from 9 to 90 kev is not proportional to $E^{-\frac{1}{2}}$, but can be represented by $\sigma = 3.96E^{-0.367}$ with σ in barns and the neutron energy E in kev. Angular distribution of the tritons are presented for neutron energies of 150, 200, 258, 300, 350, and 565 kev. These distributions, measured in a relative manner, are placed on an absolute scale by normalizing to the cross section data of this experiment, extended to 565 kev by use of previously measured cross sections. (auth)

22912

ELASTIC AND NONELASTIC NEUTRON CROSS SECTIONS FOR BERYLLIUM. J. B. Marion (Los Alamos Scientific Lab., N. Mex. and Univ. of Maryland, College Park) and J. S. Levin and L. Cranberg (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 114, 1584-9(1959) June 15.

A time-of-flight technique was used to measure angular distributions for the elastic scattering of neutrons from beryllium in the energy range from 2.6 to 6.0 Mev. Total neutron cross sections were also measured and the following nonelastic (total minus elastic) cross sections obtained: 2.60 Mev (0.27 ± 0.13 barn), 3.50 (0.43 ± 0.10), 4.10 (0.51 ± 0.08), 5.00 (0.60 ± 0.08), and 6.00 (0.73 ± 0.07). Differential cross sections were also obtained for the inelastic neutrons leaving Be^9 in the 2.43-Mev excited state. Integration of these angular distributions yielded the following inelastic cross sections: 3.50 Mev (0.23 ± 0.04 barn), 4.10 (0.25 ± 0.04), and 5.00 (0.34 ± 0.05). A continuous spectrum of neutrons was observed which corresponds to the direct (n,2n) reaction and/or the excitation of the Be^9 "level" at 1.7 Mev. This continuum was found to have an angular distribution roughly symmetric about 90°. The 2.43-Mev state of Be^9 was found to decay by neutron emission to the ground state of Be^8 with a branching ratio of 12 ± 5%. (auth)

22913

INTERNAL CONVERSION IN Li^7. R. D. Leamer (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 114, 1590-4(1959) June 15.

Upper and lower limits were placed on the internal conversion coefficient of the 479 kev excited state of Li^7. The limits are 16.6×10^{-7} and 5.8×10^{-7}, yielding a multipole mixture of (100% to 55%) M1 and (0% to 45%) E2 for the gamma ray. Photoelectric emission from the source and the background counting rate impose the principal limitations on the accuracy of the experiment. (auth)

22914

SCATTERING OF 14-Mev NEUTRONS BY CARBON. John B. Singletary and Donald E. Wood (Northwestern Univ., Evanston, Ill.). Phys. Rev. 114, 1595-9(1959) June 15.

Differential and total cross sections were determined for scattering of 14.1-Mev neutrons from several levels in carbon. The data were measurements of scattered neutrons made by means of the proton recoil reaction in nuclear emulsion plates. The inelastic cross sections were 203 mb for the 4.4-Mev level, 96 mb for the 9.6-Mev level and 124 mb for the unresolved higher levels. The shape of the angular distribution for the 4.4-Mev level indicated the possibility of some direct interactions. No significant amount of scattering was observed due to the 7.6-Mev level. The elastic scattering angular distribution showed a forward peaked diffraction type structure and yielded a cross section of 805 mb. Comparisons are made with other data on the elastic and 4.4-Mev level scattering. (auth)

22915

DECAY OF Zn^{61}. James B. Cumming (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 114, 1600-4 (1959) June 15.

The 88.5-sec activity observed among the products of the bombardment of nickel with 16-Mev alpha particles is assigned to Zn^{61}. The decay properties of this isotope were investigated by beta and gamma scintillation techniques and by coincidence measurements. Approximately 80% of the Zn^{61} beta decays are to the ground state of Cu^{61}. The positron end point is 4.38 Mev which corresponds to a log ft of 5.2 and to an allowed transition. Gamma rays of 0.48, 0.98, and 1.64 Mev were observed with intensities of 11.2, 2.9, and 6.2% of the positrons. There is some indication of gamma rays at 0.69 Mev and possibly other energies in lower intensities. A decay scheme is proposed which incorporates the above data into an existing level scheme of Cu^{61} derived from (p,γ) experiments. (auth)

22916

L TO K ELECTRON CAPTURE RATIO IN Ge^{71}. D. E. Rehfuss and Bernd Crasemann (Univ. of Oregon, Eugene). Phys. Rev. 114, 1609-11(1959) June 15.

By comparison of the number of 0.175-Mev gamma rays occurring in the decay of As^{71} with the number of gallium K x-rays proceeding from Ge^{71} K capture, the relative amount of L capture in Ge^{71} was determined indirectly. Solid sources and a scintillation spectrometer were employed. The Ge^{71} L/K electron capture ratio is found to be 0.09 ± 0.05, in agreement with theory. (auth)

22917

NEUTRON ACTIVATION AT 195 kev. W. S. Lyon and R. L. Macklin (Oak Ridge National Lab., Tenn.). Phys. Rev. 114, 1619-20(1959) June 15.

Neutron activation cross sections were measured at 195 kev (50 kev energy spread) for about 30 isotopes, by absolute gamma counting. Absolute calibration was effected by determining the RdTh-D_2O neutron source strength with a flat response 4π graphite sphere neutron counter, and irradiating indium in the form of a thin, uniform, spherical shell. The results are in general agreement with those of other investigators. The 25-kev activation cross sections of Pr^{141}, Zr^{94}, Ga^{71}, and Pd^{108} were revised. (auth)

22918

TOTAL PHOTONUCLEAR ABSORPTION IN Al. M. V. Mihailović, G. Pregl, G. Kernel, and M. Kregar (J. Stefan Inst., Ljubljana, Yugoslavia). Phys. Rev. 114, 1621-2(1959) June 15.

A direct measurement of the total photonuclear absorption in Al was carried out with improved resolution using a Compton spectrometer for analysis of the bremsstrahlung and absorption spectrum. The maximum value for the cross section is found to be 100 ± 10 mb; the integrated cross section is estimated to about 800 mb Mev. (auth)

22919

NUMERICAL EVALUATION OF DEUTERON STRIPPING CROSS SECTIONS AND POLARIZATIONS. W. Tobocman (Rice Institute, Houston, Tex.). Phys. Rev. 115, 98-107(1959) July 1.

The distorted-wave Born approximation is applied to deuteron stripping reactions. Optical potentials with rounded edges are used to distort the wave functions used. It is found possible to get a fair fit to the (d,p) cross section in four cases and to the (d,p) polarization in one case with this treatment without introducing a cutoff. (auth)

22920

DECAY OF K^{43}. N. Benczer-Koller, A. Schwarzschild, and C. S. Wu (Columbia Univ., New York). Phys. Rev. 115, 108-14(1959) July 1.

The decay of K^{43} was reinvestigated in an attempt to clarify the discrepancies existing in the ordering of the energy levels of Ca^{43}. The external conversion spectrum showed lines corresponding to the following gamma-ray energies: 0.220 ± 0.002, 0.371 ± 0.002, 0.388 ± 0.002, 0.394 ± 0.002, 0.591 ± 0.003, and 0.614 ± 0.004 Mev. In addition a γ ray of 1.005 Mev was observed in the scintillation spectrum. β-γ coincidence measurements establish that the gamma transitions to the ground state are the 0.371-Mev and the 0.591-Mev gamma rays and not the 0.614-Mev gamma as believed previously. These results and the γ-γ coincidence measurements indicate only one possible level scheme in Ca^{43}: 0, 0.371, 0.591, 0.985, and 1.373 Mev. These energy levels as well as their proposed spin and parity assignments are in good agreement with the results from the Massachusetts Institute of Technology nuclear reaction data. A two-cycle baffle for the solenoid β spectrometer is described. This baffle reduces significantly the background due to scattered gamma radiation from very strong external conversion sources. (auth)

22921

BETA DECAY OF Bk^{250} AND Bk^{249}. Susanne E. Vandenbosch, Herbert Diamond, Ruth K. Sjoblom, and Paul R. Fields (Argonne National Lab., Lemont, Ill.). Phys. Rev. 115, 115-21(1959) July 1.

The beta decay of Bk^{250} was studied with a beta spectrometer. Two beta groups are known for Bk^{250}: 725 ± 15 kev (89 ± 1% abundant) and 1760 ± 50 kev (11 ± 1% abundant). Conversion electron lines corresponding to 42.2, 98.2, 890, 930, 990, and 1032-kev transitions were observed and their intensities measured. The information obtained from crystal spectrometer singles and coincidence measurements was combined with beta spectrometer data to construct a decay scheme for Bk^{250} involving gamma vibrational levels in Cf^{250} analogous to those found in Pu^{238}. The beta half life of Bk^{250} is 193.3 ± 0.3 minutes. The electron capture partial half life of Bk^{250} is estimated to be greater than 50 hours. The beta spectrum of Bk^{249} shows an allowed or first-forbidden transition with an end-point energy of 125 ± 2 kev. (auth)

22922

ANGULAR DISTRIBUTIONS OF NEUTRONS INELASTICALLY SCATTERED FROM SODIUM. E. N. Shipley, G. E. Owen, and L. Madansky (Johns Hopkins Univ., Baltimore). Phys. Rev. 115, 122-6(1959) July 1.

The angular distribution and total cross section for neutron inelastic scattering proceeding to the first excited state in sodium were measured by observing the neutron-gamma coincidences. The measured total cross sections for the various neutron energies used are σ_T(3.49 Mev) = 370 ± 120 mb, σ_T(3.75 Mev) = 270 ± 90 mb, and σ_T(4.00 Mev) = 280 ± 90 mb. The differential cross sections were found to be higher in the backward than in the forward directions. (auth)

22923

DETERMINATION OF THE DIPOLE MOMENT AND ISOTOPE SHIFT OF RADIOACTIVE Hg^{197} BY "DOUBLE RESONANCE." Adrian C. Melissinos (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 115, 126-9 (1959) July 1.

Paramagnetic resonance was established between m-sublevels ($\Delta m = \pm 1$, $\Delta F = 0$) of the $^3P_1$ state of radioactive Hg^{197} at 3000 Mc/sec. From these data the nuclear interaction constant A was found to be (513.5 ± 1) × 10^{-3} cm^{-1}, and barring hfs anomalies it lead to a ratio of moments $\mu_{197}/\mu_{199} = A_{197}/A_{199} = 1.045$; further, the nuclear spin of Hg^{197} was ascertained to be $\frac{1}{2}$. The double resonance was combined with magneto-optic scanning to give the isotope shift of Hg^{197}, which was found to be in the 2537 A line + (91 ± 5) × 10^{-3} cm^{-1} from Hg^{198}. The radioactive mercury was produced by the $Au^{197}(d,2n)Hg^{197}$ reaction and used in vapor form. Satisfactory signals were obtained with as few as 3×10^{12} atoms. (auth)

22924

DIPOLE AND QUADRUPOLE MOMENTS OF THE ISOMERIC Hg^{197*} NUCLEUS; ISOMERIC ISOTOPE SHIFT: Adrian C. Melissinos and Sumner P. Davis (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 115, 130-7(1959) July 1.

The hyperfine structures of five optical lines of 65-hour radioactive Hg^{197} and 25-hour isomeric Hg^{197*} were measured. Radioactive mercury produced by cyclotron bombardment and excited in electrodeless discharge tubes containing as few as 5×10^{12} atoms, free of natural mercury, gave adequate light intensities. The analysis of the hyperfine structure confirmed the magnetic dipole moment and isotope shift of Hg^{197} in its ground state ($I = \frac{1}{2}$), and gave the following values for Hg^{197*} (based on $I = \frac{13}{2}$): $\mu_{197*} = -1.04 \pm 0.01$ nm; $Q_{197*} = (1.5 \pm 0.3) \times 10^{-24}$ cm^2; isotope shift displacement (from Hg^{198} in the 2537 A line) + 70 ± 7 × 10^{-3} cm^{-1}. Thus an isomeric shift of atomic energy levels resulting from the excitation of the nucleus from its ground state $I = \frac{1}{2}$ to the isomeric state $I = \frac{13}{2}$ is observed. In the 2537 A line of mercury this shift amounts to $-21 \pm 6 \times 10^{-3}$ cm^{-1}. (auth)

22925

RANGE-ENERGY RELATIONS FOR PROTONS IN Be, C, Al, Cu, Pb, AND AIR. R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 115, 137-42(1959) July 1.

Range-energy relations for protons were obtained for six substances; Be, C, Al, Cu, Pb, and air. The calculations of the energy loss dE/dx include the shell corrections at low energies and the density effect which becomes important in the high-energy region. The present results can also be used to determine the range of μ mesons up to ~10 Bev. Besides the calculated values of the ranges, tables of the ionization loss dE/dx are also presented. (auth)

22926

SCATTERING OF 29.2-Mev He^3 NUCLEI BY DEUTERONS. J. S. C. McKee and D. R. Sweetman (Univ. of Birmingham, Eng.); P. V. March and W. T. Toner (Univ.

of Glasgow); and W. M. Gibson (CERN, Geneva). Phys. Rev. 115, 143(1959) July 1.

Differential cross sections for He^3 particles elastically scattered from deuterium are presented for angles from 10 to 40° (lab). Cross sections obtained previously for the same process are also shown, and there is good general agreement between the two sets of results. (auth)

22927

INVESTIGATION OF THE $Be^9(p,n)B^9$ AND $Be^9(p,\alpha\gamma)Li^6$ REACTIONS. Jerry B. Marion (Los Alamos Scientific Lab., N. Mex. and Univ. of Maryland, College Park) and Jules S. Levin (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 115, 144-9(1959) July 1.

A pulsed-beam time-of-flight technique was used to study neutrons and γ rays from the proton bombardment of Be^9 in the energy range from 2.3 to 5.4 Mev. Excitation curves for the ground-state neutron group from the $Be^9(p,n)B^9$ reaction were measured at 0° and 90°. These curves show the well-known resonances at 2.56 and 4.6 Mev and, in addition, show a broad maximum near 3.5 Mev. The γ-ray excitation curve also indicates maxima at 2.56, 3.5, and 4.5 Mev. The 3.5- and 4.6-Mev resonances are tentatively assigned to p- and d-wave states having ($J = 2^+$, $T = 1$) and ($J = 3^-$, $T = 1$), respectively. The previously observed maximum near 4.9 Mev appears to be the result of the effect of the 3.5-Mev resonance on the n_1 group immediately above its threshold. The cross section for the production of continuum neutrons is appreciable for proton energies above about 3 Mev. A large fraction of these neutrons appear to result from the neutron decay of the 2.43-Mev Be^9 level following the inelastic excitation of this level. (auth)

22928

NUCLEAR SPECTROSCOPIC STUDIES OF NEUTRON-DEFICIENT ISOTOPES IN THE RARE EARTH REGION. Kenneth S. Toth and John O. Rasmussen (Univ. of California, Berkeley). Phys. Rev. 115, 150-7(1959) July 1.

The conversion-electron spectra of four neutron-deficient rare earth isotopes are presented and discussed. The four isotopes are Tb^{153}, Tb^{154}, Dy^{155}, and Ho^{160}. Mihelich, Harmatz, and Handley in a recent publication have presented the conversion-electron data of a large number of rare earth isotopes, including all but one (Dy^{155}) of the four above-mentioned activities. The agreement between the two works is good. Some additional conversion lines, not reported by Mihelich et al., are identified as belonging to the decay of Tb^{153}, Tb^{154}, and Ho^{160}. Decay schemes are proposed for Dy^{155} and Tb^{153}, Tb^{154}, and Ho^{160} decay to levels in Gd^{154} and Dy^{160}, respectively. The electron-capture decay data of Tb^{154} and Ho^{160} are compared with data obtained by other workers in the negatron decay of Eu^{154} and Tb^{160} to levels in Gd^{154} and Dy^{160}, respectively, and transitions common to both modes of decay are noted. (auth)

22929

NEW TERBIUM ISOTOPE Tb^{152}. Kenneth S. Toth, Kenneth T. Faler, and John O. Rasmussen (Univ. of California, Berkeley). Phys. Rev. 115, 158-9(1959) July 1.

A careful examination of photon and electron spectra from cyclotron-produced mixtures of light terbium isotopes led to the identification of a new isotope, Tb^{152}, with an 18.5-hr half life. The 344.1-kev transition from first excited state to ground in daughter Gd^{152} was identified and shown to be identical in energy to a transition associated with the beta decay of 9.3-hr Eu^{152m} to the same daughter nucleus. Gamma transitions of 180 and 265 kev are also assigned to the decay of Tb^{152}. (auth)

22930

ANALYSIS OF ANGULAR DISTRIBUTIONS IN THE REACTION $B^{11}(\alpha,p)C^{14}$. L. L. Lee, Jr. and J. P. Schiffer (Argonne National Lab., Lemont, Ill.). Phys. Rev. 115, 160-5(1959) July 1.

Angular distributions of protons from the $B^{11}(\alpha,p)C^{14}$ reaction were measured with alpha-particle energies ranging from 2.0 to 3.7 Mev. Eight resonances were observed, corresponding to states in N^{15} in the range from 12.50 to 13.60 Mev excitation. Analysis in terms of the compound nucleus formalism has yielded spin and parity assignments for the six most prominent resonances. (auth)

22931

C^{14}-N^{14} MASS DIFFERENCE AND MASS EXCESSES OF SOME LIGHT NUCLIDES. L. Friedman, W. Henkes, and D. Christman (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 115, 166-9(1959) July 1.

Mass excesses of the nuclides H^1, D^2, C^{12}, C^{14}, N^{14}, O^{18}, and Ar^{40} were determined by measurement of 18 parent molecule ion doublets with the mass synchrometer. The C^{14}-N^{14} difference, 156.44 ± 0.29 kev, was obtained from measurements on the doublets [$C^{14}O^{18}$-O_2], [$N^{14}O^{18}$-O_2], [$C^{14}H_4$-H_2O], [$C^{14}CH_2CO$], and [N_2H_4-O_2] and other doublets which give some of those above. This is in excellent agreement with the value of 156 ± 1 kev obtained from determination of the C^{14} beta end point. The consistency of these data supports the 1 kev upper limit for the neutrino rest mass derived from the H^3-He^3 mass difference and the H^3 beta end point, and also supports the argument that mass synchrometer data are essentially free of systematic errors of the magnitude required to account for discrepancies between nuclear reaction and mass spectrographic mass excesses of C^{12} and O^{18}. Mass excesses of the light nuclides determined were slightly higher than recently published mass synchrometer data, but agreement was generally within 1 μMU. (auth)

22932

ENERGY LEVELS IN Na^{23} FROM THE $Ne^{22}(p,\gamma)Na^{23}$ REACTION. J. J. Singh, V. W. Davis, and R. W. Krone (Univ. of Kansas, Lawrence). Phys. Rev. 115, 170-3 (1959) July 1.

The gamma-ray excitation function for the $Ne^{22}(p,\gamma)$ reaction was investigated in the energy range of 600 to 1800 kev. Eleven resonances could definitely be identified to result from this reaction. The cascades leading to the ground state of Na^{23} were determined and found to proceed for the most part through well-known lower lying states, although no gamma rays corresponding to transitions through the 2.08 and 2.39 Mev were observed at any of the resonances investigated. (auth)

22933

DECAY OF $_{64}Gd^{161}$(3.73 min). L. C. Schmid and S. B. Burson (Argonne National Lab., Lemont, Ill.) and J. M. Cork (Univ. of Michigan, Ann Arbor). Phys. Rev. 115, 174-7(1959) July 1.

The decay of Gd^{161}(3.73 min) is characterized by beta emission to excited states in Tb^{161}. This activity was investigated by means of the Argonne 256-channel scintillation coincidence spectrometer and photographic internal-conversion-electron spectrographs. Sources were prepared by neutron irradiation of Gd, enriched in Gd^{160}, in the Argonne reactor, CP-5. The presence of

three beta-ray branches is deduced; two of these were observed experimentally by means of absorption methods. Fourteen gamma rays are reported. These radiations are fitted into a decay scheme which indicates excited states in Tb^{161} at 56.6, 134.0, 315.3, 417.6, 480.6, and 586.1 kev. A rotational band, based on the ground state and including the first two excited states, is indicated. Spin and parity assignments are also suggested for the third and fourth excited states. (auth)

22934

DECAY OF $_{60}Nd^{151}$(12 min). L. C. Schmid and S. B. Burson (Argonne National Lab., Lemont, Ill.). Phys. Rev. 115, 178-81(1959) July 1.

The decay of Nd^{151}(12 min) is characterized by beta emission to excited states in Pm^{151}. This activity was investigated by means of the Argonne 256-channel scintillation coincidence spectrometer and photographic internal-conversion-electron spectrographs. Sources were prepared by neutron irradiation of neodymium oxide, enriched in Nd^{150}, in the Argonne reactor CP-5. The presence of six beta-ray branches is deduced; four of these were observed experimentally by means of absorption methods. Thirty gamma transitions are reported. Twenty-seven of these and the six beta-ray groups are fitted into a decay scheme which indicates the presence of excited states in Pm^{151} at 0.1172, 0.2560, 0.4265, 0.5336, 0.852, 0.937, 1.12, 1.29, 1.63, 1.87, and 2.17 Mev. The total energy difference between the Nd^{151} parent and the Pm^{151} ground state is found to be (2.4 ± 0.1) Mev. The low-lying levels in Pm^{151} are discussed with particular reference to the possible existence of a rotational series based on the ground state. (auth)

22935

STATISTICS OF SLOW-NEUTRON "NEGATIVE" ENERGY RESONANCES. P. A. Egelstaff (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 115, 182-4(1959) July 1.

Neutron cross sections measured with very slow neutrons often reveal the influence of levels below the neutron binding energy. The published data on 20 isotopes are analyzed in such a way that the properties of the levels below and above the binding energy may be compared. It is found, in particular, that the neutron-width and level-spacing distributions for these (– and +) levels are the same within the limits of the present analysis. (auth)

22936

DECAY OF SHORT-LIVED BARIUM AND LANTHANUM FISSION PRODUCTS. R. P. Schuman, E. H. Turk, and R. L. Heath (Phillips Petroleum Co., Idaho Falls, Idaho). Phys. Rev. 115, 185-7(1959) July 1.

The half lives and gamma-ray spectra of the short-lived barium and lanthanum fission products were measured. Ba^{141} has a half life of 18 ± 1 min and emits x rays and gamma rays of 120, 190, 290, ~350, 460, 640, and 740 kev. Ba^{142} has a half life of 11 ± 1 min and emits x rays and gamma rays of 80, ~260, 890, 970, 1080, 1200, 1360, and 1680 kev. La^{141} has a half life of 3.85 ± 0.10 hr and emits a low intensity gamma ray at 1370 kev. La^{142} has a half life of 85 ± 6 min and emits gamma rays of 640, 900, 1030, 1080, 1370, 1540, 1750, 1920, 2080, 2400, 2570, 3000, 3300, and 3650 kev. (auth)

22937

DECAY OF $_{50}Sn^{113}$ (112 DAYS) AND $_{49}In^{113m}$ (1.73 hr). S. B. Burson, H. A. Grench, and L. C. Schmid (Argonne National Lab., Lemont, Ill.). Phys. Rev. 115, 188-91 (1959) July 1.

Samples of Sn^{113}(112 days) were produced by neutron irradiation of tin enriched in Sn^{112}. The gamma rays were studied by scintillation methods using the Argonne 256-channel analyzer; the internal-conversion electrons were investigated by means of a 180° β-ray spectrometer. In addition to the well-established 393-kev gamma ray, a gamma ray of 255 kev was found. Studies of all the tin radioisotopes showed the latter to be in the Sn^{113} activity. Energy levels in In^{113} at 393 and 648 kev, the latter having spin ½ or ³⁄₂, are indicated. (auth)

22938

ISOMERIC STATE OF PLATINUM-199. Morris A. Wahlgren and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Phys. Rev. 115, 191-3(1959) July 1.

An isomeric state of platinum-199 was produced by thermal-neutron irradiation of normal and enriched platinum samples. The isomer decays with a half-life of 14.1 ± 0.3 seconds by the emission of γ rays of 32 ± 2 and 393 ± 2 kev energy. The thermal-neutron activation cross section of Pt^{198} for the formation of the isomer is 0.028 ± 0.003 barn. Tentative level assignments are made, consistent with systematics and shell theory. (auth)

22939

OVERHAUSER EFFECT IN METALLIC LITHIUM. M. Gueron and Ch. Ryter (Centre D'Etudes Nucleaires, Saclay, France). Phys Rev. Letters 3, 338-40(1959) Oct. 1.

An experiment performed to detect the Overhauser nuclear polarization in lithium metal is described. The sample was LiH heavily irradiated by pile neutrons. Measurements were made at 4.2 and 300°K. (W.D.M.)

22940

MOMENTS OF INERTIA OF EVEN-EVEN RARE EARTHS. J. J. Griffin and M. Rich (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. Letters 3, 342-3(1959) Oct. 1.

Numerical computations based on Belyaev's equation for the moment of inertia for even-even nuclei were made for 26 rare-earth nuclei which exhibit rotational spectra. Results lend support to the superconductor theory of nuclear pairing effects. (W.D.M.)

22941

NEW MODEL FOR VIBRATIONAL SPECTRA IN EVEN-EVEN NUCLEI. T. Tamura (Univ. of California, Los Angeles) and L. G. Komai (Hughes Microwave Lab., Culver City, Calif.). Phys. Rev. Letters 3, 344-6 (1959) Oct. 1.

The vibrating surface model is the simplest among those presented in explaining the vibrational spectra of even-even nuclei. Experimentally observed spectra indicate deviations from it. These deviations are discussed and a new potential energy term is introduced in the Wilets-Jean model to bring about a change in the spectrum. The nucleus Cd^{114} is considered. (W.D.M.)

22942

ANGULAR DISTRIBUTIONS FROM STRIPPING REACTIONS OF LOW Q VALUES. J. P. F. Sellschop (Univ. of the Witwatersrand, Johannesburg). Phys. Rev. Letters 3, 346-8(1959) Oct. 1.

Proton groups from the reactions $Li^7(d,p)Li^8$ and $C^{12}(d,p)C^{13}$ (3.09-Mev state) were studied for a range of deuteron energies between 0.5 and 2.5 Mev using high-resolution magnetic analysis. The examples pre-

sented indicate an unusually high degree of agreement between experimental angular distributions and a simple stripping theory uncorrected for Coulomb and other effects. (W.D.M.)

22943

COLLISION OF A NUCLEON WITH ENERGY OF APPROXIMATION 3×10^{14} ev WITH A NUCLEON IN PHOTOEMULSION. J. Gierula. Postepy Fiz. 9, 91-3(1958). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 5266.)

A photograph of a nuclear star observed during the exposure of a stack of emulsions is presented.

22944

THE ELASTIC SCATTERING OF NEUTRONS BY DEUTRONS WITH ALLOWANCE FOR POLARIZATION. P. G. Burke and F. A. Haas (University Coll., London). Proc. Roy. Soc. (London) A252, 177-86(1959) Sept.

Previous calculations of the elastic scattering of low energy (< 10 Mev) neutrons by deuterons have shown a discrepancy between the calculated and observed doublet scattering lengths. It has been suggested that this may be partly due to the neglect of polarization of the deuterons and the present paper attempts to make an allowance for this effect. The problem is formulated in a variational manner and a trial function is adopted which includes an explicit polarization parameter. The internucleonic interaction is assumed to be central with Gauss radial dependence and the unperturbed deuteron ground state wave-function is represented by two Gauss terms. Using the Kohn method and taking an MHWB type exchange force, S phases were evaluated on DEUCE and compared with the non-polarization results of Burke & Robertson (1957). Polarization effects in this approximation are found to be negligible. (auth)

22945

NUCLEON EXCHANGE EFFECTS IN DEUTERON STRIPPING REACTIONS AND ANGULAR DISTRIBUTIONS OF $Be^9(d,n)B^{10}$ REACTION. Kenji Hasegawa and Yoshi H. Ichikawa (Tohoku Univ., Sendai). Progr. Theoret. Phys. (Kyoto) 21, 569-80(1959) Apr.

Ordinary deuteron stripping theory has been extended to include the heavy particle stripping process by antisymmetrizing a final state wave function with respect to an ejected nucleon and a target nucleon. A formalism presented by Owen and Madansky is inconsistent for discussing an interference effect between the ordinary deuteron stripping process and the heavy particle stripping process. Experimental results of angular distributions of the $Be^9(d,n)B^{10}$ ground state neutron are well reproduced by the present theory. (auth)

22946

PHOTODISINTEGRATION OF THE DEUTERON AT HIGH ENERGIES. Shih-Hui Hsieh (Nagoya Univ., Japan). Progr. Theoret. Phys. (Kyoto) 21, 585-92 (1959) Apr.

It is shown that the photodisintegration of the deuteron up to about 140 Mev can be well accounted for only by the nucleon parts, if many effects are correctly treated. It is pointed out that the influence of the nature of the triplet odd state (which is the final state of the electric dipole transition) is remarkable, and the necessity of using exact multipole formulas at high energies is emphasized. (auth)

22947

ON THE THEORY OF NUCLEAR REACTIONS INVOLVING COMPLEX PARTICLES. O. G. Sitenko (Kharkov State Univ. and Inst. of Physics and Tech., Academy of Sciences, USSR). Ukrain. Fiz. Zhur. 4, 152-63(1959) Mar.-Apr. (In Ukrainian)

The theory of nuclear reactions involving complex particles is considered in the quasiclassical approximation. The kinetic energy of an incident complex system scattered by a central field is assumed to be large in comparison with the coupling energy. The interaction of the complex system with the central field is described by means of a unit scattering matrix, represented in the form of the product of the scattering matrices for the individual particles included in the complex system $S = \prod S_k$. The asymptotics of the wave functions of the relative motion of the complex system and the scattering center after collision are found by means of Huygens' principle. The amplitude of scattering for a system of particles in a central field is given. The integral cross sections of elastic and inelastic scattering are defined, and the integral cross section of complete scattering is given. The distribution of the recoil particles by momenta is defined. A general expression is also obtained for the complete reaction cross section under the influence of the incident complex system. The reaction cross section σ_r describes all processes during which the number of particles in the initial system changes. The complete cross section of all processes is given. In the case of weak interaction $|\eta_k| \ll 1$ the results obtained agree with the results of the Borne approximation. The cross section of stripping reaction when one of the particles originally entering into the incident system is captured by the scattering center is found. The distribution of the liberated particles in stripping by momenta is defined. The results obtained are applicable not only to the scattering of a system of interacting particles on a scattering center, but may also be applied to the scattering of an individual particle on a system of interacting particles. (auth)

22948

INVESTIGATION OF THE SPECTRUM OF PHOTOPROTONS PRODUCED BY γ-QUANTA WITH ENERGIES LYING IN THE NARROW INTERVAL FROM 82 TO 89 Mev. E. B. Bazhanov (Leningrad Inst. of Physics and Tech. Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 374-9(1959) Aug. (In Russian)

Energy spectra were investigated for protons ejected from C^{12} and Al^{27} by γ quanta from bremsstrahlung spectra possessing peak energies of 82 and 89 Mev. The experimental data are compared with the curves computed on basis of Dedrick's data. Although the agreement is not very good it may nevertheless be possible that there is a contribution of a quasideuteron mechanism to the interaction between the γ quanta and the indicated nuclei. (auth)

22949

HEAVY NUCLEI FLUX IN THE PRIMARY COSMIC RADIATION AT A GEOMAGNETIC LATITUDE OF 31°N. K. I. Alekseeva and N. L. Grigorov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 380-8(1959) Aug. (In Russian)

The flux of primary heavy particles in the stratosphere was measured with an apparatus consisting of a telescope surrounded by hodoscope counters and two pulse ionization chambers placed between the trays of the telescope counters. The ionization produced in each of the chambers by single particles with a charge $Z \geq 1$ traversing the telescope was measured. The flux of primary α particles at the top of the atmosphere at

a geomagnetic latitude of 31°N was found to be equal to 0.335 ± 0.035 particles cm^{-2} min^{-1} $sterad^{-1}$ which is (16 ± 2)% of the total particle flux. The flux of primary particles with Z > 2 under similar conditions was found to be equal to 0.019 ± 0.006 particles cm^{-2} min^{-1} $sterad^{-1}$ which is ~6% of the number of α particles and about 1% of the total particle flux at the top of the atmosphere at a geomagnetic latitude of 31°N. (auth)

22950

RESULTS OF A STUDY OF DISINTEGRATION OF CARBON NUCLEI BY 660 Mev PROTONS. A. P. Zhdanov and P. I. Fedotov (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl' i Teoret. Fiz. 37, 392-8(1959) Aug. (In Russian)

Disintegration of the carbon nuclei of a suspension of diamond particles introduced in nuclear emulsions was investigated. The yield cross sections of the various reactions were obtained. An analysis of the angular and energy distributions of the disintegrations was carried out under the assumption of the existence of two stages in the interaction between high-energy particles and light nuclei. (auth)

22951

SOME FEATURES OF SPONTANEOUS FISSION OF U^{238}. B. D. Kuz'minov, L. S. Kutsa'eva, V. G. Nesterov, L. I. Prokhorova, and G. P. Smirenkin. Zhur. Eksptl' i Teoret. Fiz. 37, 406-12(1959) Aug. (In Russian)

The mean number of neutrons emitted per event of spontaneous fission of U^{238}, $\bar{\nu} = 2.1 \pm 0.1$ and also the quantity $(\bar{\nu^2} - \bar{\nu})/\bar{\nu}^2 = 0.95 \pm 0.05$ which characterizes the neutron distribution were measured by the double coincidence method. The values thus obtained and the results of previous studies of neutron emission in spontaneous fission of U^{238} do not agree with the semi-empirical laws valid for most nuclei investigated. The number of neutrons emitted per gram uranium was determined and found to be (64.5 ± 2.0) g^{-1} $hour^{-1}$. The decay constant and spontaneous fission period computed on basis of the data obtained are, respectively, (31 ± 1.5)g^{-1} $hour^{-1}$ and (6.5 ± 0.3) · 10^{15} years. (auth)

22952

GROUND STATES OF NONSPHERICAL ODD NUCLEI ACCORDING TO THE INDEPENDENT PARTICLE MODEL. D. A. Zaikin (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 37, 540-5(1959) Aug. (In Russian)

The level scheme of nucleons in a spheroidal well with vertical walls is computed by using the asymptotic expansions of the spheroidal wave functions. The results are in good agreement with the experimental data on the spins and parities of the ground and isomeric states of nonspherical odd nuclei. (auth)

22953

α-SPECTRA OF SAMARIUM NATURAL MIXTURE. A. A. Vorob'ev, A. P. Komar, V. A. Korolev, and G. E. Solyakin (Leningrad Inst. of Physics and Tech.). Zhur. Eksptl'. i Teoret. Fiz. 37, 546-8(1959) Aug. (In Russian).

The α-spectrum for natural samarium was studied with an argon filled, pulse ionization chamber equipped with an electron-collecting filter. The half-width line for Sm^{147} α spectra is 43 kev; for intense α emitters (U^{234}) it is 30 kev. Measurements of ionization and α particle energy for Sm^{147} showed $E_\alpha = (2.19 \pm 0.01)$ Mev. An upper-limit estimate of Sm^{146} in the natural mixture, considering the half life of $Sm^{147} = 10^{12}$ years (the percentage in the natural isotopic mixture) and $T(Sm^{146}) = 5 \times 10^7$ years, was 2.5×10^{-6}%. The latest mass-spectrometric data show the magnitude 8×10^{-5}%. (R.V.J)

22954

PROTON SUBSHELL Z = 100. N. N. Kolesnikov and A. P. Krylova (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 37, 550-3(1959) Aug. (In Russian)

Anomalous properties of element 102 isotopes, observed on the simple graph of α energy dependence on N, are analyzed. Experimental and theoretical data on the α decay Q relationship to neutron number are plotted and correlated, and graphs of α decay lifetime (τ_α,sec) dependence on particle energy are given. Preliminary studies of spontaneous fission graphs show the boundary for nuclei with lifetime ~10^{-12} to 10^{-16} sec between Z = 108 and 112. (R.V.J.)

22955

DECAY SCHEME OF Bi^{210} ISOMER. S. B. Golenetskii, L. T. Rusinov, and Yu. I. Filimonov. Zhur. Eksptl'. i Teoret. Fiz. 37, 560-2(1959) Aug. (In Russian)

A decay scheme is developed for Bi^{210m}. The energy of RaE α decay into Tl^{206} is $Q_\alpha = 5064 \pm 15$ kev with Tl^{206} $E_{\beta\,max} = (1510 \pm 10)$ kev. The total α -decay energy of long life isomer of Bi^{210}, considering nuclear recoil and γ yield is $Q_\alpha = (5286 \pm 15)$ kev, or 220 kev larger than the RaE α decay. It is assumed that with RaE $T_{1/2}$ = 5.01 decay the B^{210} is in the ground state, with $T_{1/2} = 2.6 \times 10^6$ years it is metastable. The partial life time of Bi^{210} in relation to the electromagnetic transition T_γ was estimated by the accumulation of Pu^{210} in series disintegration through RaE. The intensity of the Po^{210} α line, 5300 kev < 0.01%, corresponds to $T_\gamma > 10^{10}$ years. (R.V.J.)

Theory

22956 AECU-4365

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas and Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

THE IMAGINARY PART OF THE OPTICAL POTENTIAL. L. C. Gomes. 1959. 13p. Contract AT(30-1)-2098. (Notas de Física, Vol. V, No. 8). $3.30(ph), $2.40(mf) OTS.

The imaginary part of the optical potential was investigated for low energy incoming neutrons, by means of the nucleon-nucleon cross sections in nuclear matter. The cross sections were calculated under the assumption that pair correlations for low excited states of nuclear matter are the same as those formed in the ground state. The dependence of the effective mass on the single particle momentum was taken into consideration using an empirical solution which reproduces the present assumption for the single particle spectrum. The results were applied to the nuclear surface in the Thomas-Fermi approximation. The maximum in the imaginary potential was found to be at the surface outside of the half-density radius. For low incident energies it is about 1.5 fermis beyond this radius. (auth)

22957 AFOSR-TN-59-900

Stanford Univ., Calif.

NUCLEON STRUCTURE AND ELECTROMAGNETIC INTERACTION — THEORY. Technical Note No. 3. L. I. Schiff. July 1959. 28p. Contract AF49(638)-388.

Corrections to the single-virtual-photon approximation that can arise in electron scattering processes are considered. Information is given on nucleon form fac-

tors obtainable from experiments involving polarized particles and from pion production. The theory of nucleon form factors is considered and the possible breakdown of quantum electrodynamics at small distances is discussed. (W.D.M.)

22958 APEX-468

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati and General Electric Co. Flight Propulsion Lab. Dept., Cincinnati.

AN IBM 704 PROGRAM FOR THE SOLUTION OF THE NEUTRON TRANSPORT EQUATION IN FIFTY CONCENTRIC CYCLINDRICAL ANNULI BY THE WEIL METHOD, PROGRAM I_2. Robert R. McCready and Deborah B. Vollenweider. Sept. 1959. 65p. Contracts AF33(600)-38062 and AT(11-1)-171. $1.75(OTS).

The P_3 approximation for the solution to the Boltzmann equation is developed with typical portions of the analytical detail. A general discussion of the Weil method is given, and its details are presented. The program finds fluxes, currents, average fluxes, cell corrections, and angular distributions of the flux. Various options described in detail in the program writeup are available. (auth)

22959 NAA-SR-Memo-4118

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

NUMERICAL EVALUATION OF FOURIER INTEGRALS. E. R. Cohen. July 14, 1959. 11p. $3.30(ph), $2.40 (mf) OTS.

An improved formula is presented for numerical evaluation of Fourier transforms and the application of this formula to the calculation of noise spectra is discussed. (W.D.M.)

22960 AERE-Trans-831

GREEN'S FUNCTION IN THE BOLTZMANN EQUATION FOR NEUTRONS. Khr. Ya. Khristov. Translated by D. L. Allan (U.K.A.E.A. Atomic Energy Research Establishment) from Doklady Akad. Nauk S.S.S.R. 111, 981-4(1956). 7p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 4611.

22961

DISCHARGE PHENOMENA IN LORENTZ PLASMAS: STUDY OF THE ELECTRON DISTRIBUTION IN THE PRESENCE OF A MAGNETIC FIELD. Pascal Maroni (Institut Henri Poincaré, Paris). Compt. rend. 249, 881-3(1959) Aug. 24. (In French)

Different cases of separation of the variables of an equation with partial derivatives, which obeys the electron distribution function of a Lorentz plasma, were studied. The complete integration was carried out for the case where the collision frequency is constant. (tr-auth)

22962

THE VARIATIONAL PRINCIPLE OF SPINOR FIELDS. Judith Winogradzki (Institut Henri Poincaré, Paris). Compt. rend. 249, 911-13(1959) Aug. 31. (In French)

22963

DISCHARGE PHENOMENA IN LORENTZ PLASMAS: STUDY OF THE ELECTRON DISTRIBUTION IN THE MAGNETIC FIELD. Pascal Maroni (Institut Henri Poincaré, Paris). Compt. rend. 249, 914-16(1959) Aug. 31. (In French)

The investigation of the case of the separation of the variables of an equation with partial derivatives, which obeys the electron distribution function of a Lorentz plasma, is continued. The cases for inelastic collisions, elastic collisions, and arbitrary ν_1 and ω_H are considered. (J.S.R.)

22964

ON THE CLASSICAL RADIUS OF AN ELECTRON. V. M. Yuzhakov. Izvest. Vysshikh Ucheb. Zavedenii, Fiz. No. 1, 168(1959).

In classical electrodynamics the electron radius r_0 is determined by equating the electron self-energy mc^2 to its electrostatic field or its magnetic field energy. In the first case one finds (for a uniform distribution of charge on the assumed spherical surface of the electron) $r_0 \sim 10^{-13}$ cm, while in the second case $r_0 \sim 10^{-11}$ cm. In the first case the magnetic field is not allowed for, while in the second the electrostatic field is omitted. Calculation of the electron radius with both electrostatic and magnetic fields taken into account is described. The electron momentum is equated to its electromagnetic momentum. The value of the electron radius is found to be $r_0 = ge^2/3mc^2$, where g is the gyromagnetic ratio and e is the electron charge. This value is comparable with the value of the electron radius obtained by equating its energy to the energy of the electrostatic field ($r_0 = e^2/2mc^2$). (TCO)

22965

STRUCTURE THEOREM FOR THE PHOTON PROPAGATOR. Herbert M. Fried (Univ. of California, Los Angeles). Phys. Rev. 115, 220-2(1959) July 1.

A simple theorem relating the structure of the bare and dressed photon commutators and propagators is derived, and its implication, with respect to the choice of photon gage, is discussed. (auth)

22966

GAUGE DEPENDENCE OF THE WAVE-FUNCTION RENORMALIZATION CONSTANT IN QUANTUM ELECTRODYNAMICS. Kenneth Johnson and Bruno Zumino (Univ. of California, Berkeley). Phys. Rev. Letters 3,351-2 (1959) Oct. 1

The existence of an exact and simple relation is pointed out between the electron Green's function renormalization constants in the general class of "manifestly" covariant gauges. (W.D.M.)

22967

QUASI-DEUTERON MODEL OF ATOMIC NUCLEI. [PART] I. Takashi Tagami (Univ. of Tokyo). Progr. Theoret. Phys. (Kyoto) 21, 533-61(1959) Apr.

Quasi-deuteron model is investigated, taking account of pair correlation functions in the ground state wave function of atomic nuclei. The formalism of this type makes it possible to use the cluster development method conveniently for the calculations of the expectation values or matrix elements by the model wave functions. Pair nucleon correlation functions are determined phenomenologically but self-consistently, by making use of partly the experimental information about two nucleon systems and partly the theoretical considerations for multiple scattering problem developed by Brueckner, Bethe, and their collaborators. The properties of nuclear matter are investigated as the preliminary discussion. Two nucleon correlation functions are investigated in detail for every possible spin and isospin state of the nucleon pairs. The effect of the exclusion principle on these correlation functions is given in explicit form and it is shown that on the one hand the exclusion principle plays the most important role for the appearance of the shell structure, and on

the other hand it may have some relationships with alpha particle formation on the nuclear surface. With the use of our ground state wave function, the saturation of nuclear volume energy and that of nuclear density are discussed quantitatively and the velocity dependent on particle potential is constructed self-consistently. High energy nuclear reactions, which the independent particle model without correlation fails to explain, are discussed and it is shown that the nucleon momentum distribution in nuclei is given correctly by our model. (auth)

22968

NONLOCAL INTERACTIONS AND DISPERSION RELATIONS. Yoshio Miyatake (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto) 21, 562-8(1959) Apr.

When the microscopic causality is not satisfied, the usual physical meaning to the dispersion relations proposed by Oehme can not be given. The problems of ghosts seem to be closely connected with the propagation characters in the cases of nonlocal interactions. (auth)

22969

ON THE METHOD OF THE FUNCTIONAL IN THE QUANTUM FIELD THEORY. Yu. A. Yappa. Vestnik Leningrad. Univ., Ser. Fiz. i Khim., No. 4, 172-81(1958).

An investigation was conducted on the basis of a complex function $\varphi(s)$ which is scalar with respect to the Lorentz transformations and which describes spatial field distribution; s denotes the vector in the space of coordinates $\vec{x}$ or $\vec{k}$ or in the space of impulse. The method chosen was found by V. A. Fok. The field is regarded as a system with a variable number of particles and described by the infinite columns of the function $\{\Psi_0, \Psi_1(x), \Psi_2(x_1, x_2), \ldots\}$, $\Psi_0 = \text{const}$. All columns together clearly correspond to the direct sum of the Hilbert spaces and are themselves a Hilbert space. Fok found the concrete existence of this space for a whole-numbered spin by introducing the functional $\Omega(\varphi)$. Conditions are investigated which may be satisfied by the wave function of the field $\Omega(\varphi)$. Using a theorem of non-linear functional analysis, it was proved that the necessary conditions for representation of the scalar complex wave function in form of the Fok functional in a certain domain of the Hilbert space are the local boundedness and weak differentiability within this domain. Finally, particular emphasis is laid upon the fact that the functional corresponds to the corpuscular conception. (TCO)

22970

ON SCHEMES WITH INDEFINITE METRIC. V. G. Vaks. Zhur. Eksptl'. i Teoret. Fiz. 37, 467-9(1959) Aug. (In Russian)

Unitarity and macro-causality conditions are investigated for the Lee model with an indefinite metric. (auth)

22971

WAVE EQUATIONS WITH ZERO AND NONZERO REST MASSES. V. I. Ogievetskii and I. V. Polubarinov (Joint Inst. for Nuclear Studies). Zhur. Eksptl'. i Teoret. Fiz. 37, 470-6(1959) Aug. (In Russian)

It is proved that wave equations with a nonzero rest mass are invariant with respect to a 15-parametric group of transformations which is the representation of a conformal group. (auth)

22972

ON THE RELATIVISTIC MOMENTUM AND ANGULAR MOMENTUM OPERATORS. A. P. Gel'man. Zhur. Eksptl'. i Teoret. Fiz. 37, 477-81(1959) Aug. (In Russian)

Correct expressions for the relativistic operators of the momentum and angular momentum components in orthogonal curvilinear coordinates are derived on basis of systematic application of spinor theory. (auth)

RADIATION EFFECTS ON MATERIALS

22973 AD-215580

Stevens Inst. of Tech., Hoboken, N. J.

UNCLASSIFIED LITERATURE SURVEY ON THE EFFECTS OF NUCLEAR RADIATION TO ELECTRON TUBE MATERIALS. Quarterly Report for December 1, 1958 to February 28, 1959. (Report No. 7). E. R. Johnson. 19p. Project No. 112B. Contract DA-36-039-SC-73146.

A literature survey of radiation effects on electron tube materials including ceramic tubes, thin films, and glasses is presented. The literature covered includes the literature open to the public plus special reports. No classified information is included. (J.E.D.)

22974 AECU-4295

California. Research Corp., Richmond, Calif.

THE RADIOLYSIS OF PROSPECTIVE ORGANIC REACTOR COOLANTS. Report No. 13. W. W. West. Aug. 13, 1959. 34p. Contract AT(11-1)-174. $1.00 (OTS).

Radiation damage studies were undertaken for a variety of selected organic fluids and mixtures of organics in research to develop improved coolant-moderators for nuclear reactors. Experiments were conducted in the BNL Graphite Reactor at temperatures from 600 to 860°F. Radiation dosages varied from 1.5 to 2.4×10^{18} n/cm^2. Viscosity increase, gas evolution and composition, and gross sample appearance were used as a measure of radiation damage. (W.D.M.)

22975 DC-58-5-730

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

IRRADIATION STUDY OF PLATINUM AND PLATINUM-RHODIUM THERMOCOUPLE WIRE. M. N. Myers. May 28, 1958. 4p. $1.80(ph), $1.80(mf) OTS.

The results indicate that the Ir^{192} arises principally from an (n,γ) reaction by thermal neutrons on an Ir^{191} impurity in the thermocouple wires and that this impurity is much larger (>three times) in the Pt–Rh wire than in the Pt wires tested. The ratio of impurity seems to vary from wire to wire. The new Pt–Rh wire was much more active than the used wire. Since exact MTR flux measurements were not calculable from this irradiation, quantitative values of the total amount of iridium impurity present cannot be given. (auth)

22976 EXP-NRX-101 and Add.1

[Atomic Energy of Canada Ltd., Chalk River, Ont.]

PROPOSAL FOR THE IRRADIATION OF PLUTONIUM-ALUMINUM AND URANIUM–SILICON ALLOYS IN X-2 LOOP, NRX, SEPTEMBER 1957–JANUARY 1958. T. I. Jones, J. A. L. Robertson, L. M. Howe, and L. G. Bell. Sept. 7, 1957. 8p. Addendum I: ADDENDUM TO PROPOSAL FOR EXP-NRX 101 (X-2-m). J. A. L. Robertson. Jan. 28, 1958. 2p.

A proposal is presented for irradiating Pu–Al alloys

in the high flux region for four months and a U–Si system in the outer region of the loop to a desired exposure of at least 300 Mwd/ton. It is also proposed to irradiate a defected swaged uranium oxide element and some sintered pellets of Swedish uranium oxide. (W.L.H.)

22977 NAA-SR-3085

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

GAS BUBBLE FORMATION IN IRRADIATED PLASTICS AND REACTOR FUELS. G. G. Bentle. Oct. 1, 1959. 31p. Contract AT-11-1-GEN-8. $1.00(OTS).

A transparent plastic, in which gas was formed by gamma irradiation, was used to investigate the mechanisms of gas bubble formation and growth. Bubble formation and swelling were studied for several environments, both external and internal to the plastic–gas systems. During irradiation at 100°C, larger but fewer bubbles form in the plastic than on lower temperature irradiation followed by 100°C annealing. Angular inclusions were found to increase bubble formation, and internal surfaces to promote bubble growth. Calculations indicate that volume diffusion of gas from the plastic into air is faster than into bubbles. An interpretation of these results, when applied to nuclear fuel swelling, indicates that swelling may be decreased by increasing fission rate and by decreasing the available sites for bubble nucleation and growth. (auth)

22978 NP-7900

Grumman Aircraft Engineering Corp., Bethpage, N. Y.

NEUTRON ACTIVATION RESEARCH ON SEAPLANE AIRFRAME MATERIALS. Bimonthly Report No. 4. M. D. D'Agostino and J. W. Nostrand, Jr. Mar. 1959. 12p. Contract NOa(s)-58-729. (RE-92-PR-4).

The feasibility of the activated material adherence experiment was further investigated. Based on the expected experimental errors and the associated counting statistics, our conclusion is that the experiment, as it was originally proposed, is not feasible. However, further investigations indicate that this adherence effect can be studied by another experiment which utilizes the Brookhaven Reactor as a source of neutrons. This involves the irradiation of small typical hull bottom specimens submerged in sea water. Some alloys and sealing compounds, used in the construction of British flying boats, were obtained from the Martin Company and are being incorporated into specimens which will fit our irradiation apparatus. Sea water residue, some pure elements and alloys commonly used by U. S. manufacturers will also be irradiated. (auth)

22979 RPI-17(AECL)

Atomic Energy of Canada Ltd., Chalk River Project, Chalk River, Ont.

COMMENTS ON FUEL ELEMENT SHEATH FAILURE MONITORING PROBLEMS IN NPD. P. R. Tunnicliffe. May 1, 1956. 19p. (AECL-860). $0.50(AECL).

Sheath failure monitoring in NPD is examined and a delayed-neutron monitor system is proposed for locating sheath defects quickly. A primary coolant monitor sensitive to long lived fission products is designed to initiate the search. Reactor operation during search is outlined and recommended electronic equipment is described. (J.R.D.)

22980 WADC-TN-59-167

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

RADIATION INDUCED ULTRA-VIOLET ABSORPTION IN METHYL METHACRYLATE AS A METHOD OF DOSIMETRY. [Period covered] February 1959 to May 1959. D. R. Johnson. May 27, 1959. 11p. Project title: MATERIAL ANALYSIS AND EVALUATION TECHNIQUES. Task title: RADIATION EFFECTS AND MEASUREMENTS.

A series of experiments is summarized concerned with the development of an accurate method of dosimetry for measuring dosages encountered when radiation effects are carried out at high levels, i.e., 10^{10} to 10^{12} ergs/g(C). The method utilizes the radiation-induced ultraviolet absorption in methyl methacrylate for correlation with total dosages. (auth)

22981 WAPD-IPC-492

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

RESULTS OF CR-VI-1 TEST SURFACE EXAMINATION. K. Katz. [1957]. Decl. Apr. 22, 1958. 37p. $6.30(ph), $3.00(mf) OTS.

The effect of nucleate boiling on corrosion and crud deposition in an A212B carbon steel loop was studied at high pH. No significant effect on crud deposition was found. The weight of crud deposited was ⅓ that deposited in the neutral tests. The white deposits on both boiling and non-boiling surfaces are attributed to trace impurities in the original specimens. Heat transfer surface fouling was reduced during periods of high loop leakage. (T.R.H.)

22982 CEA-tr-R-705

EFFETS DES RAYONNEMENTS SUR LES ISOLANTS. (Effects of Radiation on Insulators). Yu. K. (A.) Gus'kov and V. F. Sachkov. Translated into French by B. Vinogradoff from Atomnaya Energ. 6, 204-5(1959). 7p.

The electric conductivity of porcelain, mica, and quartz versus neutron and γ flux and versus integrated radiation was measured. The irradiation was done in a reactor at a neutron flux to 0.8×10^{13} n/cm^2 sec with a Cd to Au ratio of 1.5. Difficulties made it necessary to study also the voltage-amperage relationship from 0 to 2000v. The data are presented on graphs and discussed. (T.R.H.)

22983

RADIATION EFFECT ON INSULATORS. Yu. K. Guskov and V. F. Sachkov. Atomnaya Energ. 6, 204-5(1959) Feb. (In Russian)

Tests were made of porcelain, mica, and quartz electro conductivity dependence on neutron and γ flux. The results show that quartz, porcelain, and mica retain their insulating properties at a neutron density of 10^{13} n/cm^2/sec and an integral irradiation flux of $\sim 5 \times 10^{18}$ n/cm^2. (R.V.J.)

22984

HIGH MOLECULAR COMPOUNDS AND NUCLEAR RADIATION. M. Mihalcu and O. Constantinescu. Ind. usoară (Bucharest) 5, No. 4, 133-7(1958). (Translated from Referat. Zhur. Khim. No. 1, 1959, Abstract No. 3441.)

The reaction mechanism caused by the irradiation of high molecular weight compounds was studied.

22985

TEMPERATURE LUMINESCENCE AND DECOLORISATION OF CRYSTALS OF X-IRRADIATED QUARTZ. Ye. N. Batrak. Kristallografiya 3, 627-9(1958).

It has been suggested that when alkali ions are introduced into quartz, they must displace ions already present which compensate charge defects in the structure. The forms of the curves of temperature luminescence from irradiated quartz with introduced Li and Na

serve to confirm this. These are reproduced, the rate of heating being 0.06°/sec. Li and Na can substitute for each other with some difference in the depth of the traps. As the spectra of the supplementary absorption of smoky quartz has two extra maxima at 4500 and 6300 A, the curves of the thermal decolorization are changed at these two wave-lengths. The sharp fall of the absorption coefficient for both bands agrees with the thermal luminescence peak at 308°C. These new data confirm that the absorption bands of quartz in the visible region are connected with the localization of electrons in the levels of traps formed in association with Li and Na ions. (TCO)

RADIOACTIVE WASTE

22986 HW-57897

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A PROCEDURE FOR ESTIMATING CAPACITY OF A GROUND DISPOSAL FACILITY FOR RADIOACTIVE WASTE. A. E. Reisenauer. May 4, 1959. 15p. Contract W-31-109-Eng-52. $0.50(OTS).

Intermediate level radioactive wastes from chemical processing plants have been disposed to the ground at Hanford for several years. The disposal facilities are called cribs. These cribs vary in size from several feet square to a rectangular shape several hundred feet in length. The present method used for predicting crib life is described. Laboratory procedures for the preparation of soil and for the preparation and operation of soil columns in the laboratory are reported. (W.L.H.)

22987 HW-60601

General Electric Co. Hanford Atomic Products Operation, Richland, Wash. AQUIFER CHARACTERISTICS AND GROUND-WATER MOVEMENT AT HANFORD. W. H. Bierschenk. June 9, 1959. 77p. Contract W-31-109-Eng-52. $2.25(OTS).

The hydraulic characteristics of Hanford aquifers were measured and estimated by a variety of established field methods. These include the nonequilibrium type curve solution, the modified nonequilibrium and Theis recovery formulas, estimations from specific capacity and cyclic fluctuation data, and the results of tracer tests. Mutually consistent results show that the permeability of the glaciofluviatile sediments ranges from about 10,000 gpd/ft^2 to more than 60,000 gpd/ft^2, and the permeability of the Ringold deposits ranges from about 100 to 600 gpd/ft^2. Based on these permeability data, calculations of the average rate of ground-water flow indicate a range from a few inches per day to as much as 160 ft/day. The hydraulic studies show that wastes which reach the water table beneath disposal sites move in a general southeastward and eastward direction some 20 miles to the Columbia River. Average rates of ground-water flow indicate that travel along this estimated mean lateral path of groundwater contamination could be completed in an average time in the order of 180 years. Such factors as heterogeneity and anisotropy of the aquifers, and dispersal of wastes in the ground water, however, assume great importance in determining the path and ultimately the concentration of radioactive wastes in the water. Consequently, much additional information is needed to determine the quantitative effect of these factors in the field. (auth)

22988

A CONCENTRATOR FOR RADIOACTIVE WASTES. Nuclear Power 4, No. 41, 107(1959) Sept.

A design is given for an evaporator which could be used to solve the problem of large-scale concentration of highly active separation plant raffinate. (C.J.G.)

22989

HEARINGS ON INDUSTRIAL RADIOACTIVE WASTE DISPOSAL. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON INDUSTRIAL RADIOACTIVE WASTE DISPOSAL, JANUARY 28, 29, AND 30; FEBRUARY 2 AND 3, 1959. VOLUME 4. Washington, D. C., Joint Committee on Atomic Energy, 1959. p.2509-3057. $1.50(GPO).

A discussion of the activities of Federal and State agencies in radioactive effluent control is given, and administrative relationships between these agencies are described. (C.J.G.)

22990

FIXATION OF RADIOACTIVE WASTES IN STABLE SOLIDS. L. P. Hatch (Brookhaven National Lab., Upton, N. Y.). p.1839-44 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

A process for ultimate waste disposal which involves the adsorption and fixation of fission products in natural clay minerals is described. The design of a proposed calciner plant is presented. (C.J.G.)

22991

FIXATION AND ULTIMATE DISPOSAL. E. G. Struxness (Oak Ridge National Lab., Tenn.). p.1852-5 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

A process of mixing radioactive waste with clay and certain common fluxes and heating the mixture to form a brick or sinter is proposed. The possibility of using heat from the decay of fission products in the waste to form the sinter is described. A design of a pilot plant for self-sintering is given. (C.J.G.)

22992

THE INTERACTION OF RADIOACTIVE NUCLIDES AND SOILS. AN ACCOUNT OF OUR PRESENT POSITION WITH RESPECT TO THE BASIC PROBLEMS INVOLVED. Henry C. Thomas (Univ. of North Carolina, Chapel Hill) and N. T. Coleman (North Carolina State Coll., Raleigh). p.1861-1912 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

By assuming that fixation will never be quite complete and disposal never quite final, the problem of the fate of radioactive poisons which have escaped to the environment is discussed. A classification is given of the distribution and different kinds of surface activity exhibited by the soil minerals with emphasis on complex mixtures of hydrous oxides and clay minerals. A thermodynamic description of exchange sorption and Donnan invasion is given and thermodynamic functions for various clay systems are graphically shown. (C.J.G.)

22993

A STUDY OF THE MIGRATION OF RADIOELEMENTS IN SOILS. V. I. Spitsyn, V. D. Balukova, A. F. Naumova, V. V. Gromov, F. M. Spiridonov, E. M. Vetrov, and G. I. Grafov (Inst. of Physical Chemistry, Academy of Sci-

ences, U.S.S.R.). p.1913-37 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

A study is presented of the laws governing the sorption of uranium fission products by some natural sorbents, such as soils and soil forming minerals, from solutions with a varying salt content. Particular attention is paid to strontium-90 as the most dangerous isotope from the physiological standpoint. Laboratory tests proved that the sorption of all the known radioelements, with the exception of radiozirconium, radioniobium and radiocesium, is much more complete from alkaline solutions than from acidic. The pH of the medium had a particularly strong effect on the sorption of cerium. Up to 98 to 100% of cerium was absorbed from an alkaline solution containing sodium nitrate, regardless of the initial concentration or the quantity or nature of the soil. As for acidic media, from solutions containing aluminum, cerium was practically not absorbed at all. The degree of sorption of radioruthenium was extremely low, but in an alkaline solution it may reach several tenths of millicurie per 100 gms of soil when cationic ruthenium is used. Practically no ruthenium was absorbed from an acidic medium. Anionic ruthenium was absolutely not absorbed by soils. The sorption of strontium in an acidic medium was several times lower than in an alkaline medium. When an alkaline solution with a strontium concentration of $5.32.10^{-3}$ mg-eq/1 was used, the soils, regardless of their nature, absorbed roughly 60% of the strontium. Under similar conditions only 5 to 6% of the input quantity was absorbed from an acidic aluminum solution. Apart from this, a great number of natural sorbents, mainly pure minerals of inorganic origin, making up the earths and soils was tested to determine to what degree they absorb microquantities of strontium. (auth)

22994

TREATMENT OF HIGH-LEVEL WASTES BY SINTERING. T. Tamura (Oak Ridge National Lab., Tenn.). p.1938-50 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

The effect of alumina, different clay materials, and the use of boric acid as a fluxing agent in cesium retention by sinters is discussed. Strontium retention by sinters of different clay materials is also treated. (C.J.G.)

22995

AN EXPERIMENTAL FACILITY FOR HIGH-LEVEL WASTE FIXATION STUDIES. W. J. Boegly, Jr. and E. G. Struxness (Oak Ridge National Lab., Tenn.). p.1951-65 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

A description is given of an experimental facility for high-level waste fixation which includes a furnace and mixer, an off-gas cleaning system, and devices for thermal measurements and power controls. (C.J.G.)

22996

DISPOSAL OF HIGH-LEVEL WASTES BY FIXATION IN FUSED CERAMICS. Rolf Eliassen and Morton I. Goldman (Massachusetts Inst. of Tech., Cambridge). p.1966-79 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

A study was conducted on the conversion of acid aluminum nitrate fission product wastes to relatively insoluble, high melting point glasses which can be stored safely in the ground. Of the vitreous ceramic systems, the systems $CaO-Al_2O_3-B_2O_3-SiO_2$ and $Na_2O-CaO-Al_2O_3-B_2O_3-SiO_2$ show the greatest promise. Advantages of various ceramic systems are given. (C.J.G.)

22997

THE USE OF CERAMIC SPONGES FOR ULTIMATE DISPOSAL OF RADIOACTIVE WASTES. p.2000-3 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

The process involves the firing of a highly porous clay body to about 800°C. The body is then soaked in liquid waste, dried, resoaked and the cycle repeated as many as four or five times, after which the body is fired at a temperature of about 1300°C to permanently fix the radionuclides. It was found that some ceramics will absorb a Purex waste to about 50 wt. %. (C.J.G.)

22998

STATEMENT OF WILLIAM B. HEROY, THE GEOTECHNICAL CORP., DALLAS, TEX. p.2028-35 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

Two principle methods of underground containment in geological formations under consideration are storage in sedimentary rock by means of deep wells and storage in underground openings, either natural or artificial, at shallow depths. Space in salt domes, salt beds, or in abandoned salt mines, is considered to be the most promising environment. (C.J.G.)

22999

PROBLEMS IN THE DISPOSAL OF RADIOACTIVE WASTE IN DEEP WELLS. p.2045-76 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

Radioactive waste can be disposed of safely by injection, through deep wells, into porous rocks. There is, obviously, a limit to the amount and activity of waste that can be stored in any particular formation without danger. This limit cannot be accurately determined on the basis of available information, but the data required for estimating the safe storage capacity of a reservoir can be obtained experimentally. Major problems in the disposal of radioactive waste through deep wells will be those of confining the waste, dissipating the heat generated, and protecting the disposal system against damage by corrosion or radiation. A disposal plant might comprise, in addition to the injection wells, a number of auxiliary wells which serve various functions, with facilities for chemically treating, filtering, and storing waste and diluent water. Although reliable cost estimates cannot be made on the basis of information now available, preliminary consideration suggests that the cost of disposal might run less than a dollar per gallon of high-level undiluted waste. A modest program of laboratory work and theoretical study is proposed. (C.J.G.)

23000

REACTOR FUEL WASTE DISPOSAL PROJECT. SUMMARY REPORT. Earnest F. Gloyna, Shosei Serata, Robert S. Schechter, Kermit E. Brown, and W. R. Muehlberger (Univ. of Texas, Austin). p.2223-79 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

Research performed at The University of Texas on the storage of reactor fuel wastes in salt formations is summarized. A few of the problems investigated include: geological studies of salt domes, structural stability, permeability, thermal heat effect, creep, stress distribution, time effect, chemical effect, radiation effect, cost of developing solution cavities, and development of design principle for disposal into salt cavities.

Theoretical analyses based on model tests and limited field studies have demonstrated that a salt cavity can be designed such that it is structurally stable. Although thermal factors and plastic properties of salt are very important considerations, sufficient evidence now exists which will permit the design of storage structures. The average cost to complete an average sized cavity in a salt dome for liquefied petroleum gas storage is $1.05 per barrel of storage space. (auth)

23001

STATEMENT OF BERNARD MANOWITZ, BROOKHAVEN NATIONAL LABORATORY, UPTON, N. Y. p.2324-35 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

Potential use of fission products from waste disposal is evaluated in terms of application, markets, and economic feasibility. (C.J.G.)

23002

STATEMENT OF A. F. RUPP, THE OAK RIDGE NATIONAL LABORATORY, FISSION PRODUCT PILOT PLANT. p.2335-44 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

Methods for removing the important long-lived fission products from waste solutions produced in processing spent reactor fuel elements in a pilot plant are given. (C.J.G.)

23003

STATEMENT OF DR. FRANK R. BRUCE, OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN. p.2345-56 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

Assuming 33,000 Mw of nuclear power by 1970, 300,000 Mw by 1990, and 700,000 Mw by 2000, an attempt is made to evaluate the quantitative and economic aspects of fuel processing waste disposal. Based on the use of Al-clad U, stainless steel-clad UO_2, or Zr-clad UO_2 fuel elements, the present waste storage cost is near 0.02 mill per kw-hr. (D.E.B.)

23004

SUMMARY AND EVALUATION OF ENVIRONMENTAL FACTORS THAT MUST BE CONSIDERED IN THE DISPOSAL OF RADIOACTIVE WASTE. K. Z. Morgan (Oak Ridge National Lab., Tenn.). p.2378-94 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

Radioactive contamination in the environment can be expected to increase in proportion to increases in the nuclear power industry. It is not expected that the present interim radiation exposure levels for the population at large will be exceeded in the foreseeable future. At present, medical exposure to ionizing radiation constitutes essentially all of man's radiation exposure. In the U. S., medical exposure probably is slightly greater than man's exposure to the natural background radiation. If the present level of average medical exposure is maintained in the U. S. and if the interim MPC levels for the population at large are reached (say within 20 to 50 years), the radioactive waste will contribute an exposure to man that is equal to only $\frac{1}{3}$ the exposure received from medical sources. The average dose delivered to the environment at the present time by man-made radioactive waste is very low, and even in the future if the presently recommended levels of MPC are reached, the average dose probably will be no more than 50% of that from natural background. However, because of selective deposition certain elements in the food web may concentrate some of the long-lived radionuclides, and consequently critical links in the food web might receive local doses that are very high. The end result could be a reduction in man's food supply or a destruction of some of the natural resources. (auth)

23005

FUTURE ESTIMATES AND ECONOMICS OF WASTE DISPOSAL. SUMMARY AND EVALUATION OF ENVIRONMENTAL FACTORS. James G. Terrill, Jr. (U. S. Public Health Service, Washington, D. C.). p.2395-2410 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

Over-all radiation in the environment will become more complex, and the radiation levels will generally tend to increase to a point where current health standards will be threatened. A controlling factor in the development of the atomic energy industry may be the economics of waste disposal methods necessary to meet these criteria. Thus, it is of great national importance that a firmer basis for the health standards be developed as rapidly as possible, and that economical and significant methods of analyses which can be related to these standards be developed and approved by appropriate professional organizations. (auth)

23006

PWR-WASTE OPERATIONS EXPERIENCE FROM DUQUESNE-PNROO-PHS LIAISON. APPENDIX C [OF] FUTURE ESTIMATES AND ECONOMICS OF WASTE DISPOSAL. SUMMARY AND EVALUATION OF ENVIRONMENTAL FACTORS. p.2412-28 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

Graphs are presented which represent a monthly summary of the volume of liquid and gaseous radioactive material released from the PWR to the Ohio River as compared to design criteria. (C.J.G.)

23007

STATEMENT ON INDUSTRIAL PARTICIPATION IN WASTE DISPOSAL. p.2483-87 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

Waste disposal activities are divided into two categories, long term problems of custodial care and protection of the public and activities in which there is no long term problem. Hazards arising in both categories are discussed. (C.J.G.)

23008

WASTE DISPOSAL FOR THE DRESDEN NUCLEAR POWER STATION. T. G. LeClair (Commonwealth Edison Co., Chicago). p.2488-97 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

Methods of handling various radioactive wastes at Dresden and government control exercised in this handling are discussed. A preliminary cost comparison between waste handling facilities at Dresden and that at a conventional coal-fired generating station is presented. (C.J.G.)

23009

RADIOACTIVE WASTE DISPOSAL PRACTICES FOR THE ATOMIC POWER EQUIPMENT DEPARTMENT, GENERAL ELECTRIC COMPANY, SAN JOSE, CALIFORNIA. E. A. Sadowski, J. M. Smith, and R. C. Thorburn. p.2503-8 of "Hearings on Industrial Radioactive Waste Disposal. Volume 3."

A brief description is given of the sources of radioactive waste and methods of handling wastes by the Atomic Power Equipment Department of the General Electric Company. No serious problems in waste disposal from fuel manufacture, boiling water reactor operation, or from the laboratory components have

developed. The estimated quantities and costs are outlined along with a brief discussion of possible cost reductions. (auth)

23010

HEARINGS ON INDUSTRIAL RADIOACTIVE WASTE DISPOSAL. HEARINGS BEFORE THE SPECIAL SUBCOMMITTEE ON RADIATION OF THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON INDUSTRIAL RADIOACTIVE WASTE DISPOSAL, JANUARY 28, 29, AND 30; FEBRUARY 2 AND 3, 1959. VOLUME 3. Washington, D. C., Joint Committee on Atomic Energy, 1959. p.1825-2508. $2.00 (GPO).

This volume describes and discusses the handling, treatment, and proposed ultimate disposal systems for highly radioactive wastes that are primarily evolved from irradiated fuel reprocessing plants and discusses the future estimates and economics of disposal of radioactive wastes. A summary of environmental factors related to these estimates and a discussion of the industrial viewpoint of the radioactive waste problem are included. (auth)

23011

STATEMENT OF DAVID E. PRICE, M.D., CHIEF, BUREAU OF STATE SERVICES, U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE. p.2522-31 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

Public health standards and laws governing these standards for the protection of the public from industrial radioactive waste disposal are discussed. (C.J.G.)

23012

STATEMENT OF CLARENCE W. KLASSEN, CHIEF SANITARY ENGINEER, ILLINOIS DEPARTMENT OF PUBLIC HEALTH AND TECHNICAL SECRETARY, ILLINOIS SANITARY WATER BOARD. p.2538-44 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

Industrial radioactive waste disposal experiences in relation to public health in Illinois are discussed relative to water, food, air, shelter, wastes, and the control of natural and man-made hazards. (C.J.G.)

23013

THE RESPONSIBILITY OF STATES IN THE DISPOSAL OF INDUSTRIAL RADIOACTIVE WASTES. Hollis S. Ingraham (New York State Department of Health). p.2547-78 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

The responsibility of the state in public health protection from industrial waste disposal is outlined. The program of the New York State Department of Health is specifically outlined. (C.J.G.)

23014

ACTIVITIES OF THE UNITED STATES GEOLOGICAL SURVEY IN PROBLEMS OF RADIOACTIVE-WASTE DISPOSAL. R. L. Nace (U. S. Geological Survey, Washington, D. C.). p.2580-2645 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

The principal sources and amounts of waste materials are described and the potential hazard to water resources are outlined. The present methods of waste disposal and safety aspects of these methods are discussed. Present studies and the research program devoted to safe waste disposal are described. (C.J.G.)

23015

STATUTORY RESPONSIBILITIES OF THE ICC WHICH PERTAIN TO THE TRANSPORTATION OF RADIOACTIVE WASTE MATERIALS. Kenneth H. Tuggle (Interstate Commerce Commission, Washington, D.C.). p.2646-54 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

Under Federal statutes known as the Transportation of Explosives Act and section 204 of the Interstate Commerce Act, the Commission has prescribed regulations governing the safe transportation of radioactive materials in interstate commerce. The regulations are applicable to rail and motor carriers and to shippers using those service and the services of water carriers. (C.J.G.)

23016

WASTE DISPOSAL CONSIDERATIONS IN THE NUCLEAR POWERED MERCHANT SHIP PROGRAM. Clarence G. Morse (U. S. Department of Commerce). p.2660-72 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

The first nuclear powered merchant ship is based on complete containment of all liquid and solid wastes. Some gaseous wastes will be discharged from time to time after treatment, but only under carefully controlled conditions. The Savannah embodies this principle in its design and in its operational planning. In order to reduce capital and operating costs for future nuclear powered merchant ships, studies are being undertaken to explore safe and feasible modifications of shipboard waste handling procedures. (auth)

23017

ROLE OF THE OHIO RIVER VALLEY WATER SANITATION COMMISSION. Edward J. Cleary (Ohio River Valley Water Sanitation Commission, Cincinnati). p.2673-80 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

Radioactive waste disposal control into the Ohio River is governed by the Commission. The interests and activities of the Commission are reviewed. (C.J.G.)

23018

STATEMENT OF CALIFORNIA STATE DEPARTMENT OF PUBLIC HEALTH. Malcolm H. Merrill. p.2681-2711 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

State regulations governing the disposal of radioactive wastes are stated, and the program of the Public Health Department for continuously monitoring the atmosphere, rainfall, and surface waters is reviewed. Maximum permissible activities are tabulated. (D.E.B.)

23019

THE DISPOSAL OF RADIOACTIVE WASTES. LeRoy W. Van Kleeck. p.2781-3 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

State regulations governing waste disposal in Connecticut are given, and radiation protection measurements are discussed. (C.J.G.)

23020

PROBLEMS OF RADIOACTIVE WASTE DISPOSAL IN NEW MEXICO. S. J. Leland (New Mexico Dept. of Public Health). p.2784-8 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

The experiences of the public health department of New Mexico in relation to radioactive waste discharge to the ground are described. (C.J.G.)

23021

STATE REGULATION OF RADIOACTIVE WASTES.

Daniel E. Lynch (Ohio Dept. of Health). p.2789-93 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

Waste disposal regulations in Ohio and the origin of various radioactive wastes in the state are enumerated. (C.J.G.)

23022

PENNSYLVANIA'S ROLE IN REGULATING THE DISPOSAL OF RADIOACTIVE WASTES. Karl M. Mason (Pennsylvania Dept. of Health). p. 2794-2814 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

A program for regulating liquid, gas, and solid radioactive waste disposal in Pennsylvania is described. A discussion is contained on the proposed amendment to the Atomic Energy Act of 1954, Section 274. (C.J.G.)

23023

ACTIVITIES OF TEXAS AGENCIES IN REGULATING DISPOSAL OF RADIOACTIVE WASTE. Henry A. Holle (Texas State Dept. of Health, Austin). p.2815-55 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

The majority of wastes enter the environment via the public sewer. Analysis of this practice indicates that the present amount of radioactivity in sewage creates no hazard. Surveys are being conducted to determine the current concentrations of radioactivity in milk, air, and surface waters. Regulations governing radiation exposure as applied to industrial personnel, waste disposal, and in medical work are discussed. (C.J.G.)

23024

EXPERIENCES AND OBSERVATIONS OF THE WASHINGTON STATE DEPARTMENT OF HEALTH ON PROBLEMS ASSOCIATED WITH THE DISPOSAL OF RADIOACTIVE WASTES. Emil C. Jensen and Robert L. Stockman (Washington State Dept. of Health). p.2856-65 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

Waste disposal problems confronting the health department and the program by which the health department is guided are discussed. (C.J.G.)

23025

PROBLEMS FACING STATE AGENCIES IN HANDLING TREATMENT AND DISPOSAL OF RADIOACTIVE WASTES. Emil C. Jensen, E. F. Eldridge, C. M. Everts, Jr., and H. C. Clare (U. S. Public Health Service, Portland, Oreg.). p.2866-71 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

An inventory of problems, viewpoints, resources, and requirements of states relating to control of radioactive wastes and materials as sources of contamination of the environment and radiation exposure of the general public is given. (auth)

23026

THE 1958 INTERNATIONAL CONFERENCE ON THE LAW OF THE SEA. Arthur E. Gorman (Atomic Energy Commission, Washington, D. C.). p.2875-80 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

A discussion is presented on Article 48 (from a report of the International Law Commission) which deals with the pollution of the high seas by radioactive waste. (C.J.G.)

23027

WORK OF INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION. Lauriston S. Taylor (National Bureau of Standards, Washington, D. C.). p.2889-2979 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

Committee reports on radioactive materials include: the handling of radioactive isotopes and disposal of radioactive waste; facilities necessary for laboratory work with open sources of radioactive material and distributable sources; working habits and procedures (pertaining to industrial personnel working with radioactive materials); area and personnel monitoring and decontamination; storage, transportation, and disposal of radioactive wastes. (C.J.G.)

23028

COMMENTS ON THE HEARINGS ON WASTE DISPOSAL. Ralph E. Lapp. p. 3035-8 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

Questions are brought up and discussed which were not fully covered in the Hearings before the Special Subcommittee on Radiation. (C. J. G.)

23029

RADIATION AND MAN: BASIC DATA—GLOBAL RADIATION LIMITS. Jack Schubert and Ralph E. Lapp (Argonne National Lab., Lemont, Ill.). p.3038-43 of "Hearings on Industrial Radioactive Waste Disposal. Volume 4."

It is proposed that international agreement be reached on establishing radiation limits applicable to the world's total population. Such a General Population Limit (GPL) would be at some point intermediate between the Fixed Natural Background (FNB) to which everyone is exposed and the OPL (Occupational Permissible Limit) set for small numbers of individuals occupationally exposed to radiation. It is proposed that the GPL be taken as a multiple of the FNB which in turn is fixed at 10 rem. The factors which enter into consideration of the global radiation limits are enumerated and contrasted with those involved in setting the present occupational levels. (auth)

REACTORS

General

23030 ANL-5547

Argonne National Lab., Lemont, Ill.

SUMMARY REPORT OF THE HAZARDS OF THE INTERNAL EXPONENTIAL EXPERIMENT (ZPR-V). H. H. Hummel, F. H. Martens, and D. Meneghetti. Mar. 1956. Decl. Apr. 28, 1959. 100p. Contract W-31-109-eng-38. $15.30(ph), $5.40(mf) OTS.

The Internal Exponential Experiment (ZPR-V) is to be constructed by loading up to 49 of the fuel cans, containing up to 155 kg of U^{235}, of the Fast Exponential Experiment in a 22-in. square iron tank, surrounded by an annular thermal region of fully enriched light water lattice 10 to 15 cm thick. Maximum power is about 1 kw. The fast region, thermal annulus, safety evaluation, and hazards to surrounding area are discussed. (W.D.M.)

23031 CF-57-7-51

Oak Ridge National Lab., Tenn.

DESCRIPTION OF ORNL POOL TYPE CRITICAL FACILITY. A. E. G. Bates. July 16, 1957. 20p. $3.30(ph), $2.40(mf) OTS.

The Pool Type Critical Facility (PTCF) is a low powered, highly enriched (90 to 95% U^{235}) ordinary

light water cooled and moderated, beryllium oxide reflected assembly. It is generally similar to the present BSR at ORNL, the principal modification being that the grid plate is arranged to accommodate both ORR and BSR fuel elements. The PTCF is located in the northwest corner of the existing BSR pool. The 9 × 7 lattice provides 63 fuel, control rod, or reflector positions. (W.D.M.)

23032 CF-59-8-103
Oak Ridge National Lab., Tenn.
A PRELIMINARY REPORT ON IRRADIATED ORR FUEL ELEMENT TEMPERATURES IN AIR. J. F. Wett, Jr. Aug. 26, 1959. 11p. $3.30(ph), $2.40(mf) OTS.

Irradiated ORR fuel elements were raised into the hot cell at the ORR and their plate temperatures recorded. It was concluded that an ORR element can be safely cooled by stagnant air after a decay of approximately one day. (J.E.D.)

23033 GEAP-3183
General Electric Co. Vallecitos Lab., Pleasanton, Calif. and General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.
SURVEY OF THE PHYSICS, METALLURGY, AND ENGINEERING ASPECTS OF REACTOR CONTROL MATERIALS. June 12, 1959. 396p. Contract AT(04-3)-189, Project Agreement No. 4. $3.50(OTS).

A survey of the present state of knowledge of the theory of control in nuclear reactors and a list of references to the literature in this field are presented. Recommendations for a program of work, both theoretical and experimental, are included. The choice of high neutron absorber material for a specific reactor application depends on many factors among which are: nuclear considerations, metallurgical fabricability, radiation stability, corrosion resistance, mechanical strength, cost, and availability. Materials are discussed from the engineering application standpoint. (W.D.M.)

23034 LA-2310
Los Alamos Scientific Lab., N. Mex.
DOSIMETRY FOR THE GODIVA II CRITICAL ASSEMBLY NEUTRON FLUX AND TISSUE DOSE MEASUREMENTS. J. A. Sayeg, E. R. Ballinger, and P. S. Harris. Sept. 28, 1959. 23p. Contract W-7405-eng-36. $1.25(OTS).

Estimates of neutron flux and tissue dose as a function of distance were obtained for the Los Alamos Godiva II critical assembly. Three independent types of measurements were performed: (1) neutron flux by means of the threshold detectors Pu^{239}, Np^{237}, U^{238}, and S^{32}, and bare and cadmium-covered Au^{197} foils; (2) neutron tissue dose by means of the Hurst polyethylene-ethylene proportional counter; and (3) neutron and gamma tissue dose by means of beryllium-shelled tissue-equivalent and graphite-CO_2 ionization chambers. The results for tissue dose as obtained by the above methods showed good agreement. (auth)

23035 LA-2332
Los Alamos Scientific Lab., N. Mex.
A PRELIMINARY STUDY OF A FAST REACTOR CORE TEST FACILITY. D. B. Hall, R. P. Hammond, and R. E. Peterson, eds. Aug. 1959. 129p. Contract W-7405-eng-36. $2.75(OTS).

The construction of a 20 Mw fast reactor facility is proposed for operational testing of a series of experimental cores using plutonium alloy fuel in molten form. The facility will permit tests to be carried out at specific powers of 500 watts/g for studies of fission gas purging from the liquid fuel, container resistance to corrosion and radiation damage, and continuous processing methods. Supporting programs have provided adequate technological data to permit construction of the facility and have shown promise for the general feasibility of the reactor concept. (auth)

23036 NAA-SR-4051
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
HIGH-TEMPERATURE-STRAIN FATIGUE TESTING WITH A MODIFIED DIRECT-STRESS FATIGUE MACHINE. W. F. Anderson and C. R. Waldron. Oct. 1, 1959. 38p. Contract AT-11-1-GEN-8. $1.00(OTS).

Strain fatigue tests were conducted on AISI type 304 stainless steel at room temperature and 1000°F. A commercially available, direct-stress fatigue machine was modified to provide facilities for this high-temperature-strain fatigue testing. A description of the modification required and operation of the modified machine is presented herein. Initial data indicate that type 304 stainless steel behaves according to the previously proposed plastic fatigue relation for other materials, $N^k = C\,\epsilon_p$, where $k = -0.37$ and $C = 6.56$ at room temperature and $k = -0.80$ and $C = 0.476$ at 1000°F. (auth)

23037 NAA-SR-Memo-3852
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SPATIAL DISTRIBUTION OF RESONANCE NEUTRONS IN THE MODERATOR OF REACTOR LATTICES, AND ITS EFFECTS ON RESONANCE ESCAPE PROBABILITY. E. U. Vaughan. May 13, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

The age equation is here solved approximately on the assumption that the neutron spatial distribution varies slowly with neutron age. The resonance escape probability is expressed as the exponential of a series whose terms are negligible after the second. The first term is the usual expression in terms of the effective resonance integral, while the second term contains the correction for the non-uniformity of the spatial distribution of the resonance neutrons in the moderator. This term involves a new integral, related to, but different from, the usual resonance integral. (auth)

23038 NAA-SR-Memo-4106(Rev.)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
EXTRAPOLATION LENGTH AT REACTOR BOUNDARIES. E. R. Cohen. July 28, 1959. 9p. $1.80(ph), $1.80(mf) OTS.

The formula $1 = 0.7104\,\lambda_{tr}$ which was used in the boundary condition in the AIM-II multigroup code is generalized and improved. In the formula λ_{tr} is the transport mfp and -1 is the ratio of flux density to normal derivative at the black surface. (W.D.M.)

23039 NEI-117
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
DESIGN AND OPERATION OF A HIGH TEMPERATURE FAST NEUTRON CONVERTER ROD. J. G. Melvin and D. T. Nishimura. May 1959. 20p. (AECL-866). $0.50(AECL).

A high-temperature fast neutron rod was required to study the effects of irradiation at elevated temperatures on the mechanical properties of structural materials. Such a rod was designed and installed in the NRX reactor. The operation of the rod over a period

of eight months was satisfactory except for the limited temperature control range. (auth)

23040 NP-7877
Massachusetts Inst. of Tech., Cambridge.
OPTIMIZATION OF A PRESSURIZED WATER REACTOR CORE (thesis). Richmond Gardner and Byron A. Lee. June 1957. 140p.

A parametric study of pressurized light water reactor cores was undertaken, in which both heat transfer and nuclear influences of the basic parameters on the quantity and required enrichment of the uranium fuel were considered. Methods were developed for computation of the minimum core size for a specified power output on the basis of heat transfer characteristics of the unit cell parameters. Also, the critical mass of U-235 required for a given reactor was computed. A Fourier solution for critical mass of a highly enriched, homogeneous, heavy water moderated reactor was used and methods were developed to adapt it to the low enrichment, heterogeneous, light water case, and to compute the necessary inputs. The factor by which the critical enrichment of a given reactor would have to be increased in order to attain a specified core life was also computed. A correlation was obtained between the adjusted Fourier program and experimental data; the methods selected for calculation of resonance escape probability, fast fission factor, and disadvantage factor for use in the program were also confirmed by comparison of results with experimental data. Ranges of parametric variation were chosen. For each case, an appropriate core diameter and total quantity of uranium were computed from the heat transfer characteristics associated with the parameters. (auth)

23041 NP-7915
[Army Signal Research and Development Lab.] Inst. for Exploratory Research, Belmar, N. J.
TRIGA NEUTRON SPECTRUM AND DOSE CALCULATIONS. Harry M. Murphy, Jr. Sept. 24, 1959. 11p.

The neutron spectrum and the conversion factors for sulfur dose to carbon and tissue absorbed dose are given. Neutron doses measured by threshold detectors at 6, 12, 16, 28, and 32 cm above the fuel element pins of TRIGA for a series of nominal 250 Mw bursts are given. (W.D.M.)

23042 ORNL-2784
Oak Ridge National Lab., Tenn.
DESIGN OF CHEMICAL PROCESSING PLANT FOR HOMOGENEOUS REACTOR TEST. A. M. Rom and H. O. Weeren. Oct. 21, 1959. 106p. Contract W-7405-eng-26. $2.50(OTS).

This report describes the design of the plant that was constructed to remove insoluble fission and corrosion products from the circulating fuel solution of the Homogeneous Reactor Test (HRT). (auth)

23043 SRIA-7
Stanford Research Inst., Menlo Park, Calif.
POTENTIAL APPLICATIONS OF NUCLEAR ENERGY IN A MARINE ENVIRONMENT. Eric E. Duckstad. Aug. 1959. 194p. SRI Project No. IU-2754. Contract AT(04-3)-115. $3.50(OTS).

A preliminary examination of the role of nuclear energy in marine-oriented activities was made. Areas such as fishing, including electric fishing and fish processing, extraction of food materials other than fish from seawater, marine mining and dredging, in-transit processing on factory ships, ocean floor operations, unusual sea transport vehicles, and offshore oceanographic research stations were investigated. It is concluded that in order to carry out research in the best fashion commensurate with contemporary technology, it is advisable to determine the feasibility of using nuclear energy in specialized oceanographic research applications. It is suggested that studies be conducted to determine the feasibility of adapting small, light reactors to power deep-diving research vessels and manned buoys. The use of small package-type power reactors in permanent manned sea floor laboratories, and adaptation of miniaturized and light-weight, long-lived nuclear energy sources for unmanned research buoys should also be investigated. (auth)

23044 TID-3537
Technical Information Service Extension, AEC.
INDUSTRIAL PROCESS AND SPACE HEAT FROM NUCLEAR REACTORS. A Literature Search. James M. Jacobs, comp. Oct. 1959. 9p. $0.50(OTS).

Forty-five references to the report and published literature on industrial process and space heat from reactors are listed. (W.D.M.)

23045 TID-7559(Pt.1)
Division of Reactor Development, AEC and Oak Ridge National Lab., Tenn.
FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 309p. $3.00 (OTS).

The fuel element conference provided a favorable medium for presentation and discussion of recent developments in the field of solid fuel elements. The conference was designed to replace the more general Metallurgy Information Meetings held annually in the past. The scope of the meeting embraced the design, fabrication, performance, and material problems of fuel elements. (W.D.M.)

23046 TID-7559(Pt.1)(Paper 1)
Division of Reactor Development, AEC.
FUEL CYCLE DEVELOPMENT. Clark Goodman. Paper 1 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 8p.

Nuclear power costs are discussed in terms of three general areas: capital costs, operating costs, and fuel cycle costs. The general features of the fuel cycle development program are outlined and a few of the important problems this program is expected to solve are discussed. Among the many problems to be solved are the fuel lifetime, cost reduction in chemical processing and waste disposal, cost reduction in fabrication, and the development of Pu and U^{233} as fuels for power reactors. (W.D.M.)

23047 TID-7559(Pt.1)(Paper 2)
Oak Ridge National Lab., Tenn.
NEW DEVELOPMENTS IN RESEARCH REACTOR TECHNOLOGY. J. A. Lane. Paper 2 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 19p.

At the present time, 105 research and test reactors are in operation, being built, or planned in the United States, compared to 22 in operation by the end of 1955. The most popular types are the low power training reactors and the high flux pool or tank type. This is due to the relatively low cost of the training reactors (~ $100,000) and the flexibility and high fluxes of the tank type reactors. The thermal and fast fluxes in such reactors are of the order of 1×10^{13} per Mw. In the flux-trap reactors herein described, fluxes of 10-20 ×

10^{13} per Mw may be possible. Examples of this type of reactor, which consists of an annular core with a moderating "island" and reflector, are the Thermal Test Reactor at Knolls Atomic Power Laboratory, the Argonaut at Argonne National Laboratory, and the USSR 500 kw research reactor described at Geneva. Application of the flux-trap concept to ultra-high flux reactors results in reactor designs capable of achieving fluxes in the range of $5\text{-}8 \times 10^{15}$ neutrons/cm^2(sec). Application of the concept to a High Flux University Reactor results in thermal and fast fluxes of the order of $2\text{-}3 \times 10^{14}$ at a 5 Mw power level. The cost of such a reactor is estimated to be approximately $1.5 million by the Internuclear Company. The characteristics of the Internuclear design, described in this paper, are ideal for a high level nuclear research and testing program. (auth)

23048 TID-7559(Pt.1)(Paper 3)
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
FUEL ELEMENT PROBLEMS ASSOCIATED WITH OPERATIONS OF THE ENGINEERING TEST REACTOR AND MATERIALS TESTING REACTOR. M. H. Bartz. Paper 3 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 12p.

The fuel elements for MTR are described and various design changes to the elements are discussed. Development work performed on the ETR fuel elements during the core loadings is described. (W.D.M.)

23049 TID-7559(Pt.1)(Paper 4)
Oak Ridge National Lab., Tenn.
RECENT DEVELOPMENTS IN ALUMINUM-BASE FUEL ELEMENTS FOR RESEARCH REACTORS. R. J. Beaver and J. E. Cunningham. Paper 4 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 13p.

The major differences in operating conditions for Al-base fuel elements in pool- and tank-type reactors are pointed out. The limiting or life-determining factor for both cases is discussed. Recent and significant developments in the field of Al-base fuel elements designed for research reactors are described. The fuel element of curved-plate design is presently being used in more than thirty reactors. (W.D.M.)

23050 TID-7559(Pt.1)(Paper 5)
Martin Co. Nuclear Div., Baltimore.
DEVELOPMENTAL EFFORT TO PRODUCE A TABULAR FUEL ELEMENT WITH VARIABLE FUEL LOADING. L. Frank, D. L. Eaton, and J. R. Bedell. Paper 5 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 17p.

Tubular fuel elements which can be joined into bundles without external supports offer many advantages over conventional rod and plate-type assemblies. Utilizing a tubular element and incorporating into each individual element a varying fuel load which can give an over-all non-uniform fuel distribution throughout the reactor core may offer certain advantages. Development of stainless steel and aluminum tubular fuel elements with 20% enriched UO_2 dispersed in the matrix is described. (W.D.M.)

23051 TID-7559(Pt.1)(Paper 7)
Argonne National Lab., Lemont, Ill.
NONDESTRUCTIVE TESTING OF REACTOR FUELS. W. J. McGonnagle. Paper 7 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 27p.

Nondestructive Testing is a general name given to all methods and techniques which permit testing or inspection of raw material or fabricated components without impairing the future usefulness of the material or part. The application of nondestructive testing to nuclear reactor fuel elements is discussed. Test methods discussed are arbitrarily divided into the following groups: visual, pressure and leak, penetrant, thermal, radiography, acoustic, magnetic, electrical, and electrical magnetic. All of these various methods are being applied to a variety of testing and inspection problems. (auth)

23052 TID-7559(Pt.1)(Paper 13)
American-Standard. Atomic Energy Div., Mountain View, Calif.
THE ECONOMICS OF NUCLEAR POWER GENERATION. David P. Herron and William R. Holman. Paper 13 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 23p.

Capital costs and fuel-cycle costs for nuclear power are examined to determine the costs existing today and the probable future trend. Particular emphasis is given to the effects of enrichment, fuel type and cladding, core design, and reactor type. (auth)

23053 TID-7559(Pt.1)(Paper 15)
Argonne National Lab., Lemont, Ill.
MANUFACTURING METHODS FOR THE EXPERIMENTAL BREEDER REACTOR MARK I AND MARK II FUEL LOADINGS. A. B. Shuck. Paper 15 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 22p.

The EBR-II fuel cycle, the reactor core subassembly, and fuel element are described. The proposed methods for manufacturing the U^{235} fueled Mark I loading and the U-Pu fueled Mark II loadings are described in some detail. The initial loadings will be made using a simulated equilibrium fissium alloy. These will be manufactured by non-remote methods but using the same operational sequences as the recycle material. The recycle loadings will be pyrometallurgically processed, refabricated, and reassembled by remote control in a special facility under construction adjacent to the reactor. A brief description of this plant and the remote control process is given. (auth)

23054 TID-7559(Pt.1)(Paper 16)
Nuclear Products-Erco Div., ACF Industries, Inc., Washington, D. C. and Kaiser Engineers Div., Henry J. Kaiser Co., Oakland, Calif.
DESIGN LIMITATIONS ON METALLIC URANIUM FUEL ELEMENTS FOR A GAS-COOLED REACTOR. J. K. Davidson, R. S. Miller, W. J. O'Leary, and T. E. Stephens. Paper 16 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 13p.

The use of natural U a graphite moderated gas-cooled power reactor for operation at a gas-outlet temperature of 750 to 800°F imposes severe restrictions upon the fuel element design. Experience with the irradiation behavior of uranium metal at useful surface temperatures has shown that at temperatures above 400°C, a phenomenon called "swelling" must be considered. This phenomenon is associated with the expansion of the fission gases in the weakened metal lattice and re-

sults in serious increases in volume of the U. The design of a fuel element must provide for this "swelling." Since the low multiplication factor possible in the natural uranium-graphite system dictates that the fuel be restricted to high density U, strengthening of the base metal by introducing alloying agents is limited to very low weight percentages of additives. The low multiplication factor also requires the "lumping" of the U in bodies of approximately 1 in. diameter. The practical results of these considerations are that a cylindrical metal rod of unalloyed or low alloy U metal must be considered as the basic fuel element type. The low reactivity of the natural U system also restricts the choice of structural and canning materials which can be used in the reactor core. The only metals that can be present in any appreciable amounts in such a system are Al, Mg, Be, and Zr. The bases for the design of fuel elements using natural uranium metal under gas-cooled power reactor conditions are discussed, and several possible fuel assembly designs are described. (auth)

23055 TID-7559(Pt.1)(Paper 17)
Oak Ridge National Lab., Tenn.
A BULK UO_2–STAINLESS STEEL FUEL ELEMENT FOR A GAS-COOLED REACTOR. P. Patriarca and R. L. Heestand. Paper 17 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 12p.

The basic concepts of the ORNL Gas Cooled Reactor (GCR-2) are briefly reviewed and the highlights of a report on the GCR-2 dealing with the fuel elements are presented. The fuel element consists of seven stainless steel capsules with six located at the corners of a hexagon and one centrally located. The fabrication is described in some detail and costs are briefly discussed. (W.D.M.)

23056 TID-7559(Pt.1)(Paper 18)
Argonne National Lab., Lemont, Ill.
IRRADIATION BEHAVIOR OF URANIUM–FISSIUM AND URANIUM–PLUTONIUM FISSIUM FAST REACTOR FUELS. J. H. Kittel and K. F. Smith. Paper 18 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 10p.

The fuel alloys to be used in EBR-II will contain U, Pu, and a group of fission-product elements known as "fissium." Most of the irradiation studies to date have been made on U-fissium alloys, without Pu additions. These alloys are similar in irradiation behavior to U-Mo alloys, in that if sufficient fissium is present, the desirable gamma phase can be retained so that excellent stability can be achieved. Uranium-plutonium-fissium alloys are also highly stable under irradiation, although there has been some indication that the Pu alloys may be subject to a lower swelling temperature. (auth)

23057 TID-7559(Pt.1)(Paper 23)
Battelle Memorial Inst., Columbus, Ohio.
GAS-PRESSURE BONDING OF FUEL ASSEMBLIES. S. J. Paprocki, E. S. Hodge, and C. B. Boyer. Paper 23 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 20p.

A technique of bonding fuel assemblies by utilizing high gas pressure at elevated temperatures is being investigated for the preparation of Zircaloy-clad U-Zr fuel assemblies. The components to be bonded are fabricated to final size and then assembled and sealed in an evacuated container. The sealed assembly is then subjected to a high gas pressure and temperature in a high-pressure cold-wall autoclave. Plastic flow brings the components into intimate contact, and bonding and cladding occur simultaneously to form an integral assembly. Excellent results have been obtained by bonding 5 hr at 1550°F with a helium pressure of 10,000 psi. (auth)

23058 TID-7559(Pt.1)(Paper 24)
Argonne National Lab., Lemont, Ill.
MANUFACTURE OF THE FUEL PLATES AND FUEL SUBASSEMBLIES FOR THE ARGONNE LOW-POWER REACTOR. Robert A. Noland. Paper 24 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 12p.

The Argonne Low Power Reactor, ALPR, is a light water-cooled and -moderated boiling reactor. It is rated at 3 Mw(th), a figure which is achieved by operating with a bulk coolant temperature of 216°C maximum at 300 psig. Fuel is highly enriched uranium in the form of an Al–17.5 wt.% U–2 wt.% Ni alloy. This material is clad on all sides with Al–1 wt.% Ni alloy, metallurgically bonded to the core material and to itself at all interfaces. Each of fifty-nine fuel assemblies contain nine fuel plates in an MTR array. (W.D.M.)

23059 TID-7559(Pt.1)(Paper 31)
Battelle Memorial Inst., Columbus, Ohio.
DESIGN OF OXIDE FUEL ELEMENTS. G. W. Cunningham, S. D. Beck, and B. W. Dunnington. Paper 31 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 16p.

It is assumed that at moderate temperature and burn-up the primary limitation to the use of oxide fuel is release of fission gas by diffusion. The methods of calculation developed by Lustman et al in WAPD-183, are extended and are applied to several sample cases. Some special relationships among time, temperature, burn-up, and fission-gas release are pointed out. (auth)

23060 TID-7559(Pt.1)(Paper 32)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
IRRADIATION TESTING OF NOVEL URANIUM DIOXIDE FUEL ELEMENTS. W. E. Roake. Paper 32 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 12p.

New types of fuel elements have been conceived at Hanford for PRTR, which will be applicable to Pu-enriched ceramics. Irradiation testing has followed development of fabrication techniques. Irradiation testing of four types of elements is discussed: internally-externally cooled, sintered UO_2 tubes; swage compacted oxide powders; isostatic-formed fuel elements, and low-density, non-sintered UO_2. (W.D.M.)

23061 TID-7559(Pt.1)(Paper 33)
Argonne National Lab., Lemont, Ill.
IRRADIATION BEHAVIOR OF ThO_2–UO_2 FUELS. J. H. Kittel. Paper 33 of FUEL ELEMENTS CONFERENCE HELD AT GATLINBURG, TENNESSEE, MAY 14-16, 1958. 10p.

ThO_2–UO_2 fuels have been studied because of certain advantages possessed by this type of fuel over UO_2. Pellets of ThO_2–UO_2 have been found to be highly stable dimensionally under irradiation. Various experimental assemblies which have been irradiated have included Al, Zircaloy, and stainless steel cladding, with the annulus surrounding the pellet filled with air, He, NaK, or Pb. A full-scale core of pellets lead-bonded to Al

tube-plates has been used successfully in the Borax-IV reactor. Preliminary defect tests have shown that solid fission products are retained and that only the gaseous products, Xe^{138} and Kr^{88}, are detectable in the reactor coolant system. (auth)

23062 TID-7579
Division of International Affairs, AEC.
SIXTH INTERNATIONAL CONGRESS AND EXHIBITION OF ELECTRONICS AND ATOMIC ENERGY, ROME, ITALY, JUNE 1959. (U. S. Papers). 83p. $2.25(OTS).

23063 TID-7579(p.1-16)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
BIOLOGICAL IMPLICATIONS OF RADIOACTIVE WASTES. H. A. Kornberg. 16p.

Kinds of radioactive wastes associated with atomic energy production are described and their biological distribution in the environment and their potential for harm are discussed. To assure safe production, several types of measurements are needed. Examples of these and their implications are drawn from Hanford's production experience. (auth)

23064 TID-7579(p.17-33)
Brookhaven National Lab., Upton, N. Y.
ULTIMATE DISPOSAL OF LIQUID RADIOACTIVE WASTES. L. P. Hatch. 17p. (BNL-4218).

One of the most important factors in the disposal of liquid radioactive wastes is the careful segregation under the classification of low level, intermediate level, and high level wastes. Major benefits are that full advantage may be taken of the capacity of the soil, in many regions, to remove the radioactive materials from the high volume wastes while the more elaborate and expensive disposal methods are reserved for the high level wastes, namely, the permanent storage in salt-bed cavities, and the fixation in stable solids. (auth)

23065 TID-7579(p.34-44)
Office of Operations Analysis and Forecasting, AEC.
REDUCTION OF FUEL CYCLE COSTS THROUGH OPTIMIZATION. Allen V. Butterworth. 11p.

Some of the possibilities for the reduction of fuel cycle cost through optimum use of present technology are considered. The discussion is directed toward the determination of the optimum fuel cycle, i.e., the fuel cycle which provides the lowest cost of nuclear power. Such a fuel cycle may be significantly different from the fuel cycle which results in the lowest fuel cycle cost. (W.D.M.)

23066 TID-7579(p.45-52)
Division of Licensing and Regulation, AEC.
SAFETY FACTORS TO BE CONSIDERED IN REACTOR SITING. Clifford K. Beck. 8p.

It is exceedingly difficult to decide in advance what accidents might be credible for a given plant, and hence what situations must be safeguarded against, as against the conceivable accidents which in the limit would envisage the release of all the reactors' radioactivity inventory, regardless of all safeguards. Examples of types of accidents considered credible in various types of reactors are discussed. Where accidental release of significant amounts of fission products from a particular reactor is judged to be a credible possibility, it has become customary to provide some sort of external containment structure around the assembly as a barrier of last resort. Various types of such structures and the particular usefulness of each type are discussed. Design and evaluation studies on power reactors thus far authorized have led to certain practices in selection of reactor sites, and to patterns of site characteristics which are briefly described. (auth)

23067 TID-7579(p.53-8)
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
DYNAMIC PROPERTIES OF HETEROGENEOUS WATER REACTORS. S. G. Forbes and W. E. Nyer. 6p.

A series of reactor kinetics experiments has been performed at Spert for the purpose of improving reactor safety. The principal results of these experiments are summarized with particular emphasis on the applicability to other reactors. The extension of the program in Spert III to the conditions encountered in power reactors is discussed. (auth)

23068 TID-7579(p.59-67)
Weather Bureau, Oak Ridge, Tenn.
METEOROLOGY IN RELATION TO REACTOR HAZARDS AND SITE EVALUATION. F. A. Gifford. 9p.

Meteorology is one of several environmental factors that enter into the problem of nuclear reactor site selection and hazards evaluation. More specifically, average wind and turbulence conditions control the degree to which the atmosphere can disperse radioactive material, and these factors must be carefully evaluated in reactor siting and hazards. In addition, other meteorological factors, such as prevailing winds and precipitation, have a bearing on this problem. The probable ranges of the significant meteorological quantities, at any one location and for different locations, are estimated in order to determine their effect on the reactor problem. Methods used to obtain and interpret meteorological data for this purpose are described. Interrelation between meteorological factors and the distribution of population is of primary concern, and methods of dealing with this problem are discussed. (auth)

23069 UCRL-5483
California. Univ., Livermore. Lawrence Radiation Lab.
HOT BOX—A HIGH-TEMPERATURE CRITICAL FACILITY. Harry L. Reynolds and Carl E. Walter. Mar. 30, 1959. 124p. Contract W-7405-eng-48. $2.75(OTS).

The purpose of Hot Box is the measurement of the behavior of enriched reactors at elevated temperatures which will allow the normalization of existing calculational techniques and allow a better understanding of neutron behavior at and near thermal energies. Initially, maximum temperatures will be 1200°F. Uranium foils will be 1 and 2 mils thick and moderator blocks 1 in. thick. Hot Box is located at the east end of Jackass Flats in the Nevada Test Site. (W.D.M.)

23070 WAPD-T-956
[Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh].
TEMPERATURE COEFFICIENTS OF A HIGHLY ENRICHED CORE IN SLAB GEOMETRY. S. L. Shufler, W. F. Vogelsang, R. S. Wick, and H. I. Dolnick. [195?]. 34p. $6.30(ph), $3.00(mf) OTS.

A detailed set of calculations was done with the primary purpose of predicting the experimentally measured temperature coefficient of reactivity between 20 and 90° for a highly-enriched U–Zr–Al light water moderated critical assembly with plate fuel elements in slab geometry. Experimental results are presented for a 7.4 × 29.7 × 54 inch core containing three differ-

ent kinds of cruciform-shape control rods, i.e., Cd–Ag, Cd–In–Ag, and Cd–SS. (W.D.M.)

23071 WCAP-1400

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

MULTI-REGION REACTOR LATTICE STUDIES. Monthly Progress Report for the period June 1 to July 31, 1959. Ira H. Coen. Aug. 15, 1959. 9p. Contract AT(30-1)-2176. (WMR-1). $1.80(ph), $1.80(mf) OTS.

Work tasks on which effort was expended during the period June-July 1959 and the significant progress and accomplishments made in the Multi-region Reactor Lattices Studies are briefly described. The reactor lattice studies and experiments are outlined in WMR-2(WCAP-1401). The program is centered around a series of critical experiments to be performed at the Westinghouse Reactor Evaluation Center. (W.D.M.)

23072 WCAP-1402

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

MULTI-REGION REACTOR LATTICE STUDIES. Monthly Progress Report for August 1959. Ira H. Coen. Sept. 15, 1959. 10p. Contract AT(30-1)-2176. (WMR-3). $1.80(ph), $1.80(mf) OTS.

Work tasks in the program are listed and the effort expended during August 1959 is described. Significant progress and accomplishments are indicated. (For preceding period see WCAP-1400.) (W.D.M.)

23073 CEA-tr-A-357

CONTRIBUTION À LA PILOLOGIE. (Contribution to Reactor Technology.) K. Weber. Translated into French from Ind. Org. 25, 383-6(1956). 21p.

The exploitation of reactors is considered from the economic viewpoint, and an attempt is made to determine the factors affecting the cost. The method of expressing the "yield" of a reactor is discussed in some detail. The system adopted by Atomic Energy of Canada Limited for the calculation of reactor costs is examined. 44 references. (J.S.R.)

23074 CEA-tr-R-691

MATÉRIAUX POUR LES RÉACTEURS A HAUTE TEMPÉRATURE. (Materials for High Temperature Reactors). Translated into French by B. Vinogradoff from Atomnaya Energ. 1, 84-5(1959). 4p.

Melting points are given for various metals and compounds proposed for use in high-temperature power reactors. The materials include oxides, carbides, nitrides, zirconates, silicates, phosphides, silicides, aluminides, sulfides, and beryllides, Mo, Nb, Zr, Cr, V, and Ti. (T.R.H.)

23075

USE OF THE MATRIX METHOD IN MULTI-GROUP THEORY OF NEUTRON DIFFUSION. Ivo Marek. Aplikace mat. (Prague) 2, 141-9(1958). (Translated from Referat. Zhur. Fiz. No. 12, 1958, Abstract No. 27079).

The critical radius of a spherically-symmetrical reactor with n zones is determined. The mathematical formulation of the problem leads to systems of linear differential equations with constant coefficients. With the aid of matrix notation it is possible to show that a solution exists and that it is unique. In the practical calculations, the use of such a notation is convenient in the case when the number of energy groups is not too large ($l \leq 1$).

23076

CONSTRUCTION OF AN ATOMIC REACTOR AND CYCLOTRON AT THE INSTITUTE OF ATOMIC PHYSICS, THE RUMANIAN PEOPLES REPUBLIC. Paul Rascu. Energetica (Bucharest) 6, 208-11(1958). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 7747).

The technical characteristics of the equipment in the atomic reactor of the Rumanian Institute for Atomic Physics, at a capacity of 2 Mw and of a 12 Mev cyclotron are given. The placement of the various apparatus and the first results obtained after the start of operation are described.

23077

SWIMMING POOL REACTOR. M. Trioulaire (Commissariat a l'Energie Atomique, Paris). Énergie nucléaire 1, 153-71(1959) July-Aug. (In French)

A survey is presented of the characteristics and design of swimming pool reactors. The discussion is illustrated by experiences gained with Melusine. The swimming pool, cooling, experimental facilities, power limitations, flexibility of swimming pool reactors, safety, reactor building, and cost are considered. The principal features of Melusine, Triton, well reactors, and flux swimming pool reactors are tabulated. (J.S.R.)

23078

DESCRIPTION AND CONSTRUCTION COST IN SPAIN OF AN ARGONAUT-TYPE REACTOR. Carlos Fernandéz Palomero, Luis Alvarez del Buergo, and Fernando Sostoa Esquiroz (Junta de Energia Nuclear, Madrid). Energia nuclear (Madrid) 3, No. 10, 18-38(1959) Apr.-June. (In Spanish)

The Argonaut reactor is a 10-kw thermal reactor using natural water as moderator, graphite as reflector, and 20% enriched U_3O_8 as fuel. A description is given of the reactor, with a consideration of the reactor building, core and reflector, thermal column, shielding, water circuits, control system, neutron source, instrumentation, safety circuits, and experimental possibilities. An economic study of the construction cost of this reactor in Spain is made and the results are tabulated. (J.S.R.)

23079

IN-PILE TEST LOOPS FOR NUCLEAR REACTORS. PART II. E. L. Clark. Ind. Eng. Chem. 51, No. 9, 67A-70A(1959) Sept.

The design and operation of an in-pile loop system is presented. Designs are also presented for flow, temperature, pressure, and level control systems. In addition to evaluation of fuel elements and control rods under irradiation conditions, various construction materials can be tested. Other areas of experimentation are presented. (C.J.G.)

23080

ON WELTON'S STABILITY CRITERION FOR NUCLEAR REACTORS. Henri B. Smets (Brookhaven National Lab., Upton, N. Y.). J. Appl. Phys. 30, 1623(1959) Oct.

In a simple, clear-cut proof it is shown that a nuclear reactor undergoing a step change of reactivity is stable when the casine Fourier transform of the kernel $G(\mu)$ is everywhere positive. (C.J.G.)

23081

THEORY OF ONCE-THROUGH FUEL CYCLES. S. E. Lewis (Nuclear Power Plant Co., Ltd., Knutsford, Cheshire, Eng.). J. Brit. Nuclear Energy Conf. 4, 184-8(1959) July.

The basic theory of once-through fuel cycling in Calder Hall type reactors is presented. Starting with

a long term reactivity point curve, it is shown how in a region of constant flux an equilibrium state is reached. The properties of the curve of reactivity approach to equilibrium are then derived. After defining a mean irradiation a simple problem of optimum fuel utilization without movement within the reactor is studied. Various basic schemes of fuel cycling, some of which involve nominal movement within the reactor, are considered, from a reactivity viewpoint. Brief comments are also made on the effect of these schemes on discharge irradiation and demands on handling facilities. It is seen that in order to achieve an equilibrium state fuel must be discharged before it has reached the equilibrium value. Thus the delay of commencement of continuous cycling may have considerable economic advantage and a study is made of this problem. Other implications of delayed onset are then reviewed. (auth)

23082

THE PHYSICAL PARAMETERS OF THE AQUEOUS HOMOGENEOUS REACTOR AS FUNCTIONS OF TEMPERATURE AND REFLECTOR THICKNESS. A. Peterlin and R. Kladnik. "J. Stefan" Inst. Repts. (Ljubljana) 3, 5-30(1956). (Translated from Referat. Zhur. Fiz. No. 12, 1958, Abstract No. 27085).

The critical radius in mass for aspherical homogeneous reactor of zero power with uranium enriched to 20% (UO_2SO_4 compound) with moderator was calculated. These calculations were carried out for various infinite reflectors (ordinary and heavy water, graphite) and for various finite thickness of reflector made of heavy water in the temperature range from 25 to 200°C. The effect of reflector thickness made of heavy water on the reactivity was determined for the case of an infinite cylinder. It turns out that at zero power the critical dimensions of a spherical reactor with finite reflector of heavy water are less even at 200° than for the same reactor at 25°C, but without a reflector. Particular attention is paid to problems of operation and control of the reactor at different temperatures by varying the size of the reflector. For this purpose a reflector thickness of 30 to 40 cm is found to be fully adequate. The conclusions must be verified experimentally.

23083

THE ECONOMICS OF GAS COOLED REACTORS. G. S. Vincent [Babcock and Wilcox, Ltd. (London)]. Nuclear Power 4, No. 41, 88-92(1959) Sept.

Factors influencing the relationship between capital and unit costs are investigated and formulas are derived for the capital cost, fuel replacement, and operational cost components of the cost per unit. Families of curves are constructed to show the effect of varying different parameters and a comparison is made of generating costs from nuclear and conventional stations. (auth)

23084

FIRST RESULTS ON ZENITH INVESTIGATION. Nuclear Power 4, No. 41, 105(1959) Sept.

The reactor physics of the uranium-235–thorium–graphite system is discussed relative to the loading system. Pellet patterns corresponding to various assemblies are presented. (C.J.G.)

23085

STRUCTURAL DESIGN IN HIGH-TEMPERATURE REACTORS. N. H. Triner (Pratt and Whitney Aircraft, Middletown, Conn.). Nucleonics 17, No. 10, 78-81(1959) Oct.

Structural design in high-temperature reactors is reviewed in relation to the changes needed in present stress analysis methods. (C.J.G.)

23086

SIMPLE RELATIONS DESCRIBE REACTOR POWER BURSTS. Nucleonics 17, No. 10, 98, 100-1(1959) Oct.

Modifications of some relations reported by Corben on variables that describe a reactor power burst are given. A comparison of experimental results with calculations using Corben's relations shows good agreement. (C.J.G.)

23087

STATISTICAL ANALYSIS OF POWER-REACTOR NOISE. J. A. Thie (Argonne National Lab., Lemont, Ill.). Nucleonics 17, No. 10, 102-8, 111(1959) Oct.

Fourier transform methods are used to determine the distribution of frequency components present in reactor power fluctuations. From this frequency distribution, sharp resonances in reactor transfer functions may be detected, neutron lifetime may be determined, the coefficients in differential equations governing dynamic behavior can be obtained, basic causes of reactor noises may be established, and reactor safety may be checked. A comparison of the statistical noise analysis method and the rod-oscillator tests is made relative to precision and cost. (C.J.G.)

23088

CONCERNING THE KINETICS OF A BOILING WATER REACTOR. Antun Kirhenmajer. Publs. Elektrotechn. fak. Univ. Boegradu, Mat. i fiz. No. 16, (1958). (Translated from Referat. Zhur. Fiz. No. 4, 1959, Abstract No. 7763).

A boiling-water reactor is analyzed having fundamental properties, such as relative variation in the specific power and heat flux through the surface of heat-producing elements is independent of the coordinates, and the velocity of steam bubbles is independent of the coordinates and time. The behavior of the system is considered for small variations of power. The results of the calculations are presented in the forms of graphs that show the regions of values of certain parameters, corresponding to the stability of the reactor, and also graphs of the relative variations in the power and the heat flux upon gradual variations of the reactivity.

23089

THE RATIONAL ORGANISATION OF WATER CONDITIONS IN SINGLE-CIRCUIT ATOMIC POWER STATIONS WITH BOILING-WATER REACTORS. T. Kh. Margulova. Teploenergetika 5, No. 12, 22-6(1958).

A schematic pipework-circuit diagram of an atomic power station with boiling-water reactor and isolated steam generator is examined. The turbine takes saturated steam at two different pressures, from the reactor and from a steam generator. The heating surfaces of the steam generator and the associated pipework are made of stainless steel and the remaining pipework of carbon steel. With this circuit the boiler and steam generator are both blown down and receive feed water in parallel. If a stepwise evaporative circuit is used, the reactor can form the first stage of evaporation and by using maximum blow-down the impurity content of the water in it can be greatly reduced. The steam generator is used as the second stage of evaporation and is fed only with water from the reactor, with or without mixture of feed water. Since both reactor and steam generator are separate sets at different pressures, there will be no transfer of water from the second stage to the first. Since both lots of blow-down water are

active, they are both directed to a single evaporative installation. Various circuit arrangements are diagrammed. (TCO)

23090

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER–13 SEPTEMBER 1958. VOLUME 7. REACTOR TECHNOLOGY. Geneva, United Nations, 1958. 853p. $19.50.

Volume 7 is one of three volumes dealing with reactor fuels, coolants, and structural materials. The hydraulic aspects are concerned with circulation of liquid fuels, both aqueous and metallic, and of liquid sodium coolant. The thermal aspects are concerned with heat transfer from fuel elements to coolants consisting of gases, liquids, and mixtures of the two. Papers are presented on irradiation damage and the release of Wigner energy in graphite, the detection of burst fuel elements, and equipment for the transfer of fuel and irradiation samples. (W.D.M.)

23091

INDEMNITY AND REACTOR SAFETY. HEARINGS BEFORE THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SIXTH CONGRESS, FIRST SESSION ON INDEMNITY AND REACTOR SAFETY, APRIL 29 AND 30, 1959. Washington, D. C., Joint Committee on Atomic Energy, 1959. 125p. GPO.

Details of the 2 day hearings by the Joint Committee on atomic energy liability and indemnity matters, including the operations of the AEC Advisory Committee on Reactor Safeguards are presented. Testimony by Atomic Energy personnel is given as well as others. Also included are statements submitted for the record, and correspondence inserted in the record. (J.R.D.)

23092

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS (to Westinghouse Electric International Co.). British Patent 817,265. July 29, 1959.

A pressurized-water test or research reactor is described. The pressurized water coolant flows downward through fuel channels. The moderator, D_2O, can be circulated through other channels. The reactor is simple and economical to construct and is flexible in arrangement to accommodate a wide variety of test situations. (T.R.H.)

23093

IMPROVEMENTS IN OR RELATING TO TRANSFER MECHANISMS. (to Westinghouse Electric International Co.). British Patent 817,266. July 29, 1959.

A reactor loading and unloading machine is described. The device, useful with pressurized-fluid reactors, has an inclined tubular channel which is inserted into the reactor through a seal arrangement. The fuel elements are moved hydraulically in this tube. The machine operates in an area where there is no biological shield. (T.R.H.)

23094

IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. Andrew Thomson Bowden (to C. A. Parsons and Co., Ltd.). British Patent 820,579. Sept. 23, 1959.

A reactor cooling system is described in which a polyphenyl fluid circulates through a fuel tube, then back through a space outside the fuel tube at a slower rate, then to heat exchangers. The coolant flows in a closed pressurized loop. (T.R.H.)

23095

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. James William Kendall and Dennis William Ginns (to United Kingdom Atomic Energy Authority). British Patent 821,221. Oct. 7, 1959.

A reactor cooling system is described which offers more uniform cooling. The coolant channels decrease in cross sectional area from the inlet end to offset the pickup of heat and lessening of cooling near the outlet end. Also, a valve system is provided to regulate flow through channels of varying distances from the hotter parts of the core. (T.R.H.)

23096

IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Kenneth Henry Dent and Dennis James Dawson (to United Kingdom Atomic Energy Authority). British Patent 821,263. Oct. 7, 1959.

An anti-bowing attachment for vertical finned fuel elements is described. (T.R.H.)

23097

IMPROVEMENTS IN OR RELATING TO REMOVAL OF FISSION PRODUCTS FROM NUCLEAR REACTORS. Harry Chilton (to C. A. Parsons and Co., Ltd.). British Patent 821,289. Oct. 7, 1959.

A process for fission product removal from liquid metal fuel reactors is given. The fuel is heated by fission at one point from which it rises, because of the density difference, to the surface. At the surface it boils into a vacuum. Thus more-volatile fission products are removed. (T.R.H.)

23098

HOMOGENEOUS FUEL ELEMENTS FOR NUCLEAR FISSION REACTORS. (to Deutsche Gold and Silver Scheideanstalt Vormals Roessler). British Patent 821,297. Oct. 7, 1959.

A dispersion-type fuel material is described. Elements made of this material consist of a BeO or graphite shell enclosing an extruded body of UC, graphite, and organic binder. The UC particles are smaller in diameter than the fission fragment range. This fuel element is easily processed by grinding and sifting to remove moderator-filler which contains fission fragments. (T.R.H.)

Power

23099 AECU-4361

Aerojet-General Nucleonics, San Ramon, Calif.

ARMY GAS COOLED SYSTEMS PROGRAM ENGINEERING CORE TEST. J. W. Blakley. Jan. 30, 1959. 38p. (AGN-TM-344). $6.30(ph), $3.00(mf) OTS.

The Engineering Core Test, a full-scale mockup of the GCRE-1 core, was tested under proposed GCRE-1 operating conditions of temperature and pressure. Results indicated that the GCRE core design is mechanically sound. Heat-transfer coefficients through the mockup fuel-element heater tubes were determined. (C.H.)

23100 AECU-4367

Duquesne Light Co., Shippingport, Penna.

MONTHLY OPERATING REPORT FOR AUGUST 1959. 32p. Contract AT(11-1)-292. $6.30(ph), $3.00(mf) OTS.

A summary of significant Shippingport operations and a discussion of major items which occurred during the month are presented. Major maintenance items and the test program for the month are discussed. (W.D.M.)

23101 APDA-131
Atomic Power Development Associates, Inc., Detroit.
FUEL ENRICHMENT FOR THE ENRICO FERMI REACTOR. Edward Garelis. May 12, 1959. 31p. $6.30(ph), $3.00(mf) OTS.

The enrichment of the Enrico Fermi core was determined by calculations based on critical experiments and was established at 25.6% contained U^{235} for a total uranium content of 1734 kg. This enrichment should ensure criticality for a minimum of 91 subassemblies assuming an equilibrium core for a burn-up of one percent. The uncertainty is estimated to be +20 subassemblies, i.e., a range from 91 to 111 subassemblies. The most probable number of subassemblies on initial loading to criticality is 96. (auth)

23102 BAW-1101
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
NUCLEAR MERCHANT SHIP REACTOR; DESIGN OF THE NMSR PRIMARY SHIELD. W. R. Smith and M. A. Turner. Apr. 1958. 60p. Contract AT(30-3)-274. $9.30(ph), $3.60(mf) OTS.

The primary shield in the Nuclear Merchant Ship Reactor consists of the reflector, thermal shields, pressure vessel wall, a 33-inch water annulus, and a layer of lead shielding at the exterior of the primary shield tank varying from 3 to 1 inches in thickness. The shielding calculations and techniques used in sizing the NMSR primary shield, the results obtained, and the resulting shield thicknesses are described. (W.D.M.)

23103 BAW-1152
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
LIQUID METAL FUEL REACTOR EXPERIMENT QUARTERLY TECHNICAL REPORT, JANUARY–MARCH 1959. 123p. Contract AT(30-1)-1940. $2.75(OTS).

Preparation of a technical and economical evaluation for the first large-scale reference LMFR Plant is reported. Selection of optimum economic factors is described along with containment and safety, maintenance aspects, and fuel characteristics. Reference plant arrangements are shown in drawings. Basic studies on carbides and oxides of U and Th were continued. Data are included on the dispersion of UC and ThC–UC in Bi plus 700 to 800 ppm Zr. Solid solution ThO_2–UO_2 particles were tested in tilting capsules. Results showed that about 2% of the UO_2 was reduced to U after 1445 hr at 750 to 950°F. Bench scale loop tests of ThO_2–UO_2 dispersed in Bi are reported in which the slurry was circulated at 900°F; data and observations are tabulated. The current status of dynamic corrosion testing is tabulated. The ETR in-pile corrosion loop was operated for 1400 hr at 775 to 910°F. Generally, the loop operated satisfactorily, however several deficiencies were observed. These are listed and discussed. Tests for comparison of Croloy $1\frac{1}{4}$ and $2\frac{1}{4}$ reactions under similar conditions in liquid metal are reported. Croloy $1\frac{1}{4}$ appears superior in resistance to mass transfer. Experiments are being initiated to examine the formation of a nitride film on Zr used in Bi. Elements which may reduce the N availability to Zr are being examined. Data on the reactions of Croloy $2\frac{1}{4}$ with N as a function of temperature are presented. Data on mechanical properties of Croloy steels in Bi plus Zr, U, and Mg at 885 to 975°F are tabulated, and data on graphite for use in LMFRE are given. Aluminum carbide preparation by graphite impregnation is reported and data on graphite pore volume filled with Al in this operation are given. Analog simulation work on the primary system was continued. The IHX analysis was completed and results were checked against analog data. Graphs of data show agreement in the variable transfer function. Cavitation parameter studies in which pure Bi is being used in the rotating disk are reported. Tests indicate a correlation between static pressure, and the distance of the damaged area from the disk's holes. Revision of the flow path to remove sharp turns in the LMFRE cooling system is reported. Progress in design of nonnuclear instrumentation, valves and bellows and small and large components is reported. Design and development of remote maintenance facilities such as remote viewers, control room, and remote welding equipment are discussed. (For preceding period see BAW-1135.) (J.R.D.)

23104 CF-53-1-276
Oak Ridge National Lab., Tenn.
COMPONENTS OF FLUORIDE SYSTEMS. William B. Cottrell. Jan. 27, 1953. Decl. Feb. 17, 1959. 17p. Contract W-7405-eng-26. $3.30(ph), $2.40(mf) OTS.

A summary is presented of the present status of knowledge of plumbing for a molten fluoride-salt mixture as obtained in the ANP program during the last year and one-half. Valves, pumps, level indicators and controllers, flowmeters, pressure meters, and vapor traps as components of the fluoride system are discussed. It is emphasized that while these components have been devised which are suitable for laboratory systems, considerable work remains to be done before the desired reliability can be attained for larger-scale systems. (J.E.D.)

23105 HW-61888
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DIVISION OF REACTOR DEVELOPMENT PROGRAMS MONTHLY REPORT [FOR] AUGUST 1959. L. H. McEwen, comp. Sept. 15, 1959. 42p. Contract AT(45-1)-1350. $7.80(ph), $3.30(mf) OTS.

Progress is reported on the plutonium recycle program, basic swelling studies, gas-cooled power reactor, Maritime Gas-Cooled Reactor, nondestructive fuel testing, and fixation of radioactive wastes. (W.L.H.)

23106 KAPL-2043
Knolls Atomic Power Lab., Schenectady, N. Y.
DEFUELING THE S2G REACTOR. C. V. Moore. May 28, 1959. 22p. Contract W-31-109-Eng-52. $1.00(OTS).

The defueling of the S2G Reactor which was conducted at the Electric Boat Division, General Dynamics Corporation, Groton, Connecticut during January 1959, is reported from the viewpoint of the participating personnel from Knolls Atomic Power Laboratory. The sequence of events is outlined, difficulties encountered during the operation are described, and conclusions of possible interest to other naval nuclear reactors are given. (auth)

23107 MND-E-2116
Martin Co. Nuclear Div., Baltimore.
DESIGN, FABRICATION AND PRELIMINARY TESTING OF NUCLEATE BOILING TEST SECTION. ERDL—

TASK III, PHASE 3. C. Eicheldinger. Sept. 1959. 64p. Contract DA-44-009-ENG-3043.

The design of uniform and cosine test sections for use in the local-boiling heat-transfer tests was completed. A full-scale mockup of an SM-1 flow channel was the basis for the design. The test sections will be fully instrumented for simultaneous measurement of temperatures, pressures, and voltage drops. A detector for the measurement of void volume in the test channel under local-boiling operation was designed. A burnout detector to prevent destruction of the channel during burnout tests is also incorporated. Preliminary in-loop and out-of-loop tests were performed on the uniform test channel. During one of these preliminary tests, failure of the electrical insulation resulted in burnout of the channel walls. The void detector was checked out to the point that 1% void volume can be detected. The burnout detector was found to operate satisfactorily. (auth)

23108 NAA-SR-Memo-3141
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
WATER AND ACID CONTENT OF OMRE COOLANT. R. T. Keen. Oct. 28, 1958. 5p. $1.80(ph), $1.80(mf) OTS.

The water and acid content of the OMRE coolant are of interest since they may have an effect on corrosion rates, vapor pressure, and gas solubility. Water content of the coolant averaged 0.032% with a range of 0.018 to 0.065% over the period August 1957 to August 1958. Acid number was less than 0.005 during the entire period. Complete data are shown. (W.D.M.)

23109 NAA-SR-Memo-3939
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
A REVIEW OF THE RECOIL ACTIVITY PROBLEM IN THE COOLANT OF THE PIQUA OMR. R. L. Ashley. June 12, 1959. 15p. $3.30(ph), $2.40(mf) OTS.

New information concerning the recoil range of Mg^{27} from the $Al^{27}(n,p)$ reaction was used to correct the magnitude of recoil activity previously calculated as existing in the coolant of the Piqua OMR. The effect of the film, which has been identified and measured on OMRE fuel elements, would be to reduce the importance of the recoil process in organic cooled reactors. Preliminary evaluation of a case at the OMRE for stainless steel clad fuel elements indicates that the measured Co^{58} recoil activity is about $1/15$ of that calculated. (W.D.M.)

23110 NAA-SR-Memo-4119
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PERFORMANCE TEST OF A TWO-COOLANT-REGION SODIUM PUMP SHAFT FREEZE-SEAL. F. O. Streck. July 15, 1959. 15p. $3.30(ph), $2.40(mf) OTS.

The operation of the freeze-seal type sodium pump requires a shaft freeze-seal capable of retaining sodium. A prototype two-coolant-region freeze seal for application on HNPF sodium pumps was designed and constructed. It was tested under environmental conditions to determine its operating characteristics and sodium retaining capabilities. (auth)

23111 NAA-SR-Memo-4128
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
FABRICATION OF PROTOTYPE HNPF MODERATOR CANS. L. T. Bogaert. July 22, 1959. 20p. $3.30(ph), $2.40(mf) OTS.

The tooling, fabrication methods, and assembly procedures developed for full-scale HNPF moderator cans were generally adequate. Necessary refinements were determined. Four short cans and two 14 in. by 18 ft long cans were fabricated for development testing. Seven full-scale moderator can assemblies were fabricated and inspected. (W.D.M.)

23112 NAA-SR-Memo-4303
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
RADIATION FROM THE OMRCA-I. L. Mountford and E. Wade. Aug. 25, 1959. 18p. $3.30(ph), $2.40(mf) OTS.

The maximum power level at which the OMR critical assembly may be operated is determined by the radiation level outside the exclusion area. At the beginning of the experimental program it was necessary to make a survey of the radiation from the reactor to determine the permissible operating levels. The effectiveness of the shielding and the possibility of areas of high radiation levels were investigated. Radiation levels were measured for two different reactor conditions—with the maximum upper reflector thickness and with the moderator level approximately at the top of the fuel. (auth)

23113 ORNL-1178
Nuclear Development Associates, Inc., White Plains, N. Y.
DYNAMICS OF THE SUPERCRITICAL WATER REACTOR. Gerald Goertzel, Mathew M. Shapiro, and Harry Soodak. Feb. 1, 1953. Decl. July 2, 1959. 92p. For Oak Ridge National Lab. Contracts AT(40-1)-1065 and W-7405-eng-26. Subcontract 394. $15.30(ph), $5.40 (mf) OTS.

The background work on the dynamics and control of the Supercritical Water Reactor is summarized with emphasis on the determination of the self or inherent stability of the machine. Variations in water density are found to provide a substantial amount of self regulation, and the reactor appears quite amenable to control under steady conditions. The use of a fluid which undergoes a six-fold expansion in passing through the reactor for both moderating and cooling makes necessary a more elaborate treatment of the hydrodynamic behavior of this fluid than is usual. The equations of motion of the system are derived and simplified by linearization, thus limiting the validity of the results to the case of small departures from equilibrium. The resulting partial differential equations are then transformed by a variational procedure into a system of first order, ordinary differential equations. The time responses to some disturbances of interest are then determined. Eight major reactor periods, all stable, have been found. (auth)

23114 ORNL-2751
Oak Ridge National Lab., Tenn.
NUCLEAR CHARACTERISTICS OF SPHERICAL, HOMOGENEOUS, TWO-REGION, MOLTEN-FLUORIDE-SALT REACTORS. L. G. Alexander, D. A. Carrison, H. G. MacPherson, and J. T. Roberts. Sept. 30, 1959. 22p. Contract W-7405-eng-26. $0.75(OTS).

The use of a molten-salt fuel makes possible the production of high-pressure, superheated steam with a nuclear reactor operating at low pressure. The corrosion resistance of the INOR-8 series of nickel–molybdenum alloys appears to be sufficient to guarantee reactor component life-times of 10 to 20 years.

Proposed continuous fuel-processing methods show promise of reducing fuel-processing costs to negligible levels. With U^{233} as the fuel and Th^{232} as the fertile material in both core and blanket, initial regeneration ratios up to 1.08 can be obtained at critical masses less than 600 kg. The corresponding inventory for a 600-Mw(th) central station power reactor is initially about 1300 kg. With U^{235} as the fuel, U^{233} is produced, and initial regeneration ratios in excess of 0.6 can be obtained with critical masses of less than 300 kg. The corresponding critical inventories for 600-Mw(th) central station power reactors are 600 kg or less, depending on the thorium loading. It is concluded that homogeneous, molten-salt-fueled reactors are competitive in regard to nuclear performance with present solid-fuel reactors, and they may be economically superior because of lower fuel and fuel-processing costs. (auth)

23115 ORNL-2799
Oak Ridge National Lab., Tenn.
MOLTEN-SALT REACTOR PROGRAM QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1959. Oct. 8, 1959. 105p. Contract W-7405-eng-26. $2.50(OTS).

The nuclear performance of a two-region graphite moderated molten-salt breeder reactor was studied. Reactor power was 125 Mw(th). Salt-lubricated hydrodynamic journal bearings with two axial grooves 180° apart were tested to failure. Three further tests were conducted with bearings containing three equally spaced helical grooves. Fabrication of a pump incorporating a three-axial-groove hydrodynamic bearing was completed. Construction of the Remote Maintenance Demonstration Facility was completed on schedule. One long-term corrosion test loop was terminated after a year's operation. The enthalpy and viscosity of a high-thorium-content blanket salt mixture were experimentally determined. A redetermination of the viscosities of two low-UF_4-content mixtures with the modified viscometer resulted in lower values and altered temperature dependence for both salts. Eleven INOR-8 thermal-convection loops and twelve Inconel loops were examined. A 6000-hr test and a 5000-hr test of INOR-8 exposed at 1300°F to a system containing graphite and fuel 130(LiF-BeF_2-UF_4) were completed. Inconel and INOR-8 specimens exposed to graphite-sodium systems for 4000 hr at 1400°F were carburized to a depth of 30 to 40 mils and showed a loss in ductility both at room temperature and at 1250°F. Fuel 30(NaF-ZrF_4-UF_4) and fuel 130 penetrated to 58% or more of the accessible void volume in AGOT graphite specimens when 150 psig pressure was applied in a 100-hr exposure at 1300°F. Initial gettering and flushing tests to remove oxide contaminants from graphite specimens with fuel 130 in a 20-hr exposure at 1300°F appeared to reduce the amount in uranium oxide precipitation normally observed in tests with nongettered graphite. The program for evaluating the mechanical properties of INOR-8 was reviewed. Initial studies to determine the cladability of prefabricated porous nickel for use as a leak-detecting component in a triplex heat-exchanger tube have indicated that the material can be bonded to Inconel with retention of core porosity. An INOR-8 weld-metal composition containing 2% Nb exhibited good ductility at 1500°F. Groundwork for a phase study of PuF_3 fuels is provided by cooling curves on a series of compositions from the NaF-PuF_3 binary system. Fission product behavior, particularly as related to fuel reprocessing and recovery, was studied in experiments on the solubility and precipitation of rare-earth fluorides. Solubility measurements were made on NiF_2. In a study of the compatibility of graphite with fuel, no deleterious or unfavorable effects were encountered with samples of an impervious graphite which were exposed to circulating fuel for one year in a corrosion-test loop. Two modifications of the HF dissolution process for purifying the LiF-BeF_2 carrier salt are being investigated. (For preceding period see ORNL-2723.) (W.D.M.)

23116 TID-5544(Pt.C)(Del.)
Allis-Chalmers Mfg. Co., Milwaukee.
LOW POWER MOBILE NUCLEAR POWER PLANT WITH RADIOACTIVE HEAT SOURCE. PART C. 500 KW POWER PLANT FOR GROUND PRIME MOVER. (Report No. 43-103). Final Report. F. B. Daniels and Eric R. Weber. June 15, 1952. Revised Oct. 10, 1952. Decl. with deletions Sept. 29, 1959. 34p. Contract AT(11-1)-196. $6.30(ph), $3.00(mf) OTS.

A study was made of the feasibility of using fission products as the heat source for a nuclear power plant of 500 kw net output for installation in a ground vehicle. It is shown that the use of fission products for a plant of this size is not practical because of the very large quantity of radioactive material required, and the limited output of waste products from existing and projected sources. It is concluded that a nuclear reactor is the more practical heat source for this size plant, and a provisional design of such a plant is described. (auth)

23117 TID-8510
General Nuclear Engineering Corp., Dunedin, Fla.
A BRIEF STUDY OF BOILING WATER REACTORS IN THE 5 TO 40 eMW RANGE. Oct. 10, 1959. 135p. $2.75(OTS).

The work performed in a brief study for the USAEC of boiling water reactor power plants in the 5 to 40 Mw(e) output range is summarized. Scope of the study included a description of the reactor, outline of accomplished, underway, or pending work on boiling water reactors, anticipated problems, and economic data. General conclusions are presented. (W.D.M.)

23118 TID-8513
Alco Products, Inc., Schenectady, N. Y.
SURVEY OF PWR POWER PLANTS, 10-30 eMW SIZE. Oct. 10, 1959. 253p. $4.00(OTS).

A survey of pressurized water moderated and cooled reactor plants has established this type of nuclear power plant as having proven reliability, safety, and stability. Of these, two plant designs are available which have been completed to the extent that industry is willing to quote firm prices for their construction. The remaining three plants surveyed represent extrapolation of available designs. Although the cost estimates for these three designs are not firm quotes, they give a reliable indication of the effect of size, type of fuel, and the use of oil-fired superheat on power generating costs. The survey results do not indicate that there exists a clear advantage to selecting any one of the five plants. Choice of a plant would be dependent upon the specific application of the plant. Several small plants offer more likelihood of faster advancement of technology than the few large plants which can be built for the same total dollar expenditure. The use of fossil fired superheating in conjunction with a nuclear powered steam source will reduce the net power generating costs. This is true only as nuclear heat generation remains more expensive than fossil fuel heat generation.

The main advantage of using fossil fired superheat is that this type plant can be integrated into an existing power source without greatly increasing the spare part inventory for the power conversion equipment. This advantage must be balanced against the problem of determining true costs of the nuclear power source from a hybrid station. Pressurized water reactor plants have the potential of producing economic electrical power in relatively high power cost regions of the world. The areas in which these plants can economically compete will increase as capital and fuel costs are reduced. These cost reductions can be realized by further construction of plants and additional operating experience. (auth)

23119 WAPD-MRP-81

Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh.

PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD JUNE 24, 1959 TO AUGUST 23, 1959. 96p. Contract AT-11-1-GEN-14. $2.25(OTS).

A three-dimensional study of core power distribution as a function of lifetime resulted in the adoption of new safety shutdown set points for the reactor protection system during the latter portion of core life. Feasibility studies to identify necessary plant modifications and power plant problems associated with 150 Mw operation of core 2 were completed. The most probable source of Po in the PWR primary system was determined to be fuel element surface contamination by bismuth. The effectiveness of alkaline permanganate–ammonium citrate solution for removing activated corrosion products from surfaces was found to be velocity dependent. Results of thermal and hydraulic analysis of core 2 were used to establish core design parameters pertaining to 150 Mw(w) operation. The feasibility of longitudinal and transverse welding techniques was established and data on diffusion bonding are presented. Preliminary data on electrical resistance changes after irradiation and in-pile annealing of B^{10} bearing matrices, and on fission fragment damage in ceramics are presented. Data indicate that thermal capabilities of UO_2 fuel elements are affected by the gap between pellets and cladding. Post irradiation burst testing and fusion gas release measurements of oxide plates indicate little deterioration of oxide plate fuel elements. The feasibility of pressure bonding oxide plates was established. Data on self-diffusion coefficients in UO_2 at 1600 and 1675°C are presented. Results of three-dimensional depletion analysis of PWR-1 through Seed 2 reactivity life indicate a 1000 EFPH longer life than that for Seed 1. Detailed and gross neutron measurements in a 248 kg PWR-2 mock-up were made to determine the radial peaking factors and power sharing between seed and blanket. Also the one-rod stuck shutdown margin was examined in a 248 kg PWR-2 mock-up to determine the effects of changes in control rod span, blade thickness, rod material, poison lump sizes, and lump location in the assembly. Resonance self-shielding in Pu^{239} and Pu^{240} is being incorporated in the theoretical calculations of reactivity which is compared with the experimental reactivity obtained in the long term reactivity gains program. (For preceding period see WAPD-MRP-80.) (J.R.D.)

23120 WAPD-PWR-PMM-3391

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].

FAILURE OF THE NORMAL ZIRCALOY FUEL ROD NO. 1 AND PRE-IRRADIATION TESTING OF THE REPLACEMENT FUEL RODS. Interim Report. R. F. Boyle. [1959]. 13p. $3.30(ph), $2.40(mf) OTS.

The X-I-N irradiation experiment is designed to test the hydriding mechanism of the fuel rod failure and to establish the relative merit of N-free-Fe replaced Zircaloy as compared to normal Zircaloy with respect to hydrogen adsorption behavior. The experiment consisted of two PWR-type fuel rods with a 0.005-in. drilled defect hole located ~ over the center of the first UO_2 pellet. Failure of the defected normal Zircaloy rod in the test occurred by the opening, through a water-logging action, of a crack already present in the tubing prior to irradiation. (W.L.H.)

23121 WCAP-39

Westinghouse Electric Corp. Commercial Atomic Power Activity, Pittsburgh.

QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING NOVEMBER 30, 1955. David H. Fax, ed. Dec. 30, 1955. 55p. $9.30(ph), $3.60(mf) OTS.

The over-all goal of the PAR Project was to design, construct, and place in operation an aqueous homogeneous reactor plant of 150 Mw(e) capability. Major accomplishments to Nov. 30, 1955, were the definition of the program, the assignment of technical personnel to the various subprojects of the program, renovation of facilities for offices and laboratories, and the installation of a major portion of the laboratory. (W.D.M.)

23122 YAEC-165

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

MONTHLY PROGRESS REPORT FOR THE PERIOD AUGUST 1 TO 31, 1959. H. E. Walchli. Sept. 20, 1959. 15p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph), $2.40(mf) OTS.

Progress and status of the development program on the Yankee Power Reactor are briefly summarized. (For preceding period see YAEC-124.) (W.D.M.)

23123 AEC-tr-3787

GENERAL SWEDISH ELECTRIC COMPANY, VASTERAS DESIGN OF REACTORS WITH URANIUM OR THORIUM AS FUEL FOR THE UTILIZATION OF ATOMIC ENERGY. Translated from Swedish Patent No. 157,654. Inventor: K. R. Liljeblad. 5p. $1.80(ph), $1.80(mf) JCL.

The design of a reactor which is heavy water moderated and liquid metal cooled is presented. The heavy water moderator is at atmospheric pressure and below 100°C. The fuel is contained in a hollow space in which the molten metal coolant flows. Outside of this hollow space is a tube containing the heavy water moderator. (W.L.H.)

23124

U.K.A.E.A. DISPLAY AT HOME. Atom No. 33, 19(1959) July.

A description of the British display is given. The exhibition illustrates advances made to implement the program of providing 5,000 to 6,000 Mw electricity from nuclear sources by 1966. A cutaway model of Calder Hall is included. (J.R.D.)

23125

THE HALDEN BOILING WATER REACTOR. I. AN EXPERIMENTAL POWER REACTOR IN NORWAY. J. Coehoorn, J. H. B. Madsen, and R. G. Scholvinck. Atoomenergie 1, No. 8, 131-4(1959) Aug. (In Dutch)

The selection of the reactor type and the initial plan-

ning of the project are described. The characteristics of the Halden Boiling Water Reactor, which used heavy water as coolant and moderator, are then considered with a discussion of the fuel consumption. (J.S.R.)

23126

THE HALDEN BOILING WATER REACTOR. II. AN EXPERIMENTAL POWER REACTOR IN NORWAY. J. Coehoorn, J. H. B. Madsen, and R. G. Schölvinck. Atoomenergie 1, 145-57(1959) Sept. (In Dutch)

The description of the characteristics of the Halden Boiling Reactor is continued with a consideration of the reactor tank, fuel elements, control and safety rods, primary heavy water circuit, secondary light water circuit, instrumentation and control, reactor building, and the work program of the reactor. The reactor parameters are tabulated. (J.S.R.)

23127

THE FUTURE OF ATOMIC POWER IN THE USSR. V. S. Yemel'yanov. Nauka i Zhizn 25, No. 11, 23-6(1958).

The possibilities for the use of atomic energy in the USSR are reviewed. Various atomic projects being carried out are described such as, an atomic power plant with a capacity of 420,000 kw being built in the Voronezh Oblast', another in the Leningrad Oblast', and a reactor of the water-moderated type with boiling water, with a 50,000 kw capacity under construction at the Volga in the Ul'yanov Oblast'. The Ural power plant will be equipped with four reactors, each of which will operate in a bloc system with a turbine capacity of 100,000 kw. Another atomic power plant of 2,000 kw capacity with mobile reactors and installations has just been built. (TCO)

23128

A NEW ATOMIC POWER PLANT. Nauka i Zhizn 25, No. 11, 27(1958).

In 1958, the first unit of an atomic power plant with a capacity of 100,000 kw started to operate in the USSR. The full capacity of this plant is 600,000 kw. (TCO)

23129

NEUTRONIC REACTOR FUEL ELEMENT. M. H. Shackleford (to U. S. Atomic Energy Commission). U. S. Patent 2,864,758. Dec. 16, 1958.

A fuel element possessing good stability and heat conducting properties is described. The fuel element comprises an outer tube formed of material selected from the group consisting of stainless steel, V, Ti, Mo, or Zr, a fuel tube concentrically fitting within the outer tube and containing an oxide of an isotope selected from the group consisting of U^{235}, U^{233}, and Pu^{239}, and a hollow, porous core concentrically fitting within the fuel tube and formed of an oxide of an element selected from the group consisting of Mg, Be, and Zr.

23130

REACTOR CONTROL MECHANISM. J. A. Lane, R. E. Engberg, and J. M. Welch (to U. S. Atomic Energy Commission). U. S. Patent 2,885,893. May 12, 1959.

A quick-releasing mechanism is described which may be used to rapidly drop a device supported from beneath during normal use, such as a safety rod in a nuclear reactor. In accordance with this invention an electrical control signal, such as may be provided by radiation detection or other alarm condition sensing devices, is delivered to an electromagnetic solenoid, the armature of which is coupled to an actuating mechanism. The solenoid is energized when the mechanism is in its upper or cocked position. In such position, the mechanism engages a plurality of retaining balls, forcing them outward into engagement with a shoulder or recess in a corresponding section of a tubular extension on the upheld device. When the control signal to the solenoid suddenly ceases, the armature drops out, allowing the actuating mechanism to move slightly but rapidly under the force of a compressed spring. The weight of the device will urge the balls inward against a beveled portion of the actuating mechanism and away from the engaging section on the tubular extension, thus allowing the upheld device to fall freely under the influence of gravity.

23131

JACKETED FUEL ELEMENTS FOR GRAPHITE MODERATED REACTORS. L. Szilard, E. P. Wigner, and E. C. Creutz (to U. S. Atomic Energy Commission). U. S. Patent 2,886,503. May 12, 1959.

Fuel elements for a heterogeneous, fluid cooled, graphite moderated reactor are described. The fuel elements are comprised of a body of natural uranium hermetically sealed in a jacket of corrosion resistant material. The jacket, which may be aluminum or some other material which is non-fissionable and of a type having a low neutron capture cross-section, acts as a barrier between the fissioning isotope and the coolant or moderator or both. The jacket minimizes the tendency of the moderator and coolant to become radioactive and/or contaminated by fission fragments from the fissioning isotope.

23132

NEUTRON DENSITY CONTROL IN A NEUTRONIC REACTOR. G. J. Young (to U. S. Atomic Energy Commission). U. S. Patent 2,892,765. June 30, 1959.

The method and means for controlling the neutron density in a nuclear reactor is described. It describes the method and means for flattening the neutron density distribution curve across the reactor by spacing the absorbing control members to varying depths in the central region closer to the center than to the periphery of the active portion of the reactor to provide a smaller neutron reproduction ratio in the region wherein the members are inserted, than in the remainder of the reactor thereby increasing the over-all potential power output.

STABLE ISOTOPE SEPARATION

23133 CF-54-7-12(Rev.)

Oak Ridge National Lab., Tenn.

DETERMINATION OF THE EFFICIENCY OF AN ION EXCHANGE SYSTEM IN SEPARATING THE LITHIUM ISOTOPES (PRELIMINARY STUDY). R. E. Blanco, A. H. Kibbey, and J. T. Roberts. July 22, 1954. Decl. Feb. 9, 1959. 26p. $4.80(ph), $2.70(mf) OTS.

The lithium isotopic separation factors for the ion exchange systems studied appear to be quite low, of the magnitude of 1.003. Any possible effects on the separation factor attributable to concentration or the presence of complexing agents were within the limits of experimental error. The HTU for lithium ion exchange is low, i.e., a fraction of an inch in the absence of a complexing agent, at a flow rate of 1 ml/min/cm^2 and approximately proportional to the flow rate. In the presence of a complexing agent the HTU was larger and again was proportional to the flow rate. The efficiency of the system therefore cannot be improved by increasing the throughput by means of faster flow rates. This fact plus the low separation factor make it seem unlikely that lith-

ium highly enriched in Li^7 may be economically produced by ion exchange at the present time, even in a continuous contactor. (auth)

23134 HKF-113

Ferguson (H.K.) Co. Atomic Energy Div., New York.
AMMONIA PROCESS FOR DEUTERIUM CONCENTRATION. W. I. Thompson. Sept. 4, 1951. Decl. Feb. 20, 1957. 68p. Contract AT(30-1)-1075. $12.30(ph), $4.50(mf) OTS.

A new chemical exchange process for the production of heavy water involves first the transfer of deuterium from water of natural abundance to ammonia. No concentration takes place in this step. The deuterated ammonia, which is at somewhat less than the natural abundance level, is then concentrated in a dual temperature exchange system against gaseous hydrogen. The product is removed as a solution of NH_2D in anhydrous liquid ammonia. A study was made of the process to determine the effect of some of the significant process variables on the design of a plant. A preliminary attempt was made to optimize the more important factors. Based on the most reliable data that could be found and optimistic assumptions where data were lacking, a plant was designed to recover the equivalent of 50 tons per year of D_2O from water of natural abundance. In particular, the design of the exchange towers was made with very favorable assumptions in mass transfer rate, in lieu of appropriate test data. The cost of such a plant has been estimated at about $4,800,000, and it is estimated that the heavy water can be produced for approximately $18/lb. (auth)

23135 NYO-799

New York Operations Office. Div. of Technical Advisers, AEC.
THE DEVELOPMENT OF THE DUAL-TEMPERATURE PROCESS FOR THE PRODUCTION OF HEAVY WATER. Sept. 11, 1950. Decl. Apr. 8, 1957. 136p. $21.30(ph), $6.90(mf) OTS.

The development of the Dual-Temperature Process from laboratory scale to plant production is reviewed. The Dual-Temperature Process for the production of D_2O utilizes the deuterium exchange reaction, $H_2O(liq) + HDS(gas) = HDO(liq) + H_2S(gas)$, and is based on the variation of the equilibrium constant for this reaction with temperature. Plant descriptions, flowsheets, and cost estimates are included. (J.E.D.)

23136 NYO-6055

Standard Oil Development Co. Esso Labs., Linden, N. J.
REVIEW OF THE AMMONIA–HYDROGEN DUAL-TEMPERATURE SYSTEM FOR HEAVY WATER MANUFACTURE. Final Report. Mar. 26, 1952. Decl. Mar. 4, 1957. (SOA-69). SUPPLEMENT 1. H. Z. Martin and Frank T. Barr. Mar. 28, 1952. SUPPLEMENT 2. ELIMINATION OF EQUILIBRATOR IN AMMONIA PROCESS FOR HEAVY WATER MANUFACTURE. Frank T. Barr. Feb. 19, 1953. 24p. Contract AT(30-1)-1407. $4.80(ph), $2.70(mf) OTS.

A review of the NH_3 process for D_2O manufacture is presented. Flowsheets and material-balance studies of the process are included, and comparison is made with the H_2S process. Supplement 1 continues the review of the NH_3 process, and conclusions are listed which indicate that the NH_3 process, as now known, give no promise of showing advantage over the H_2S process. Supplement 2 discusses the elimination of the equilibrator in the NH_3 process. A brief examination of the HN_3 process investment costs under these conditions reveals that the equilibrator saving would be outweighed by the increase in investment associated with smaller plant size. (W.L.H.)

23137

A SEPARATIVE CASCADE CONSISTING OF THE DIFFUSION COLUMNS. R. Ya. Kucherov and G. A. Tevzadze. Atomnaya Energ. 6, 207-8(1959) Feb. (In Russian)

The design and performance of a cascade with 10 columns are described. Data are tabulated on the separation of Ar^{36}, C^{13}, and Ne^{22}. (R.V.J.)

23138

PHOTOCHEMICAL SEPARATION OF MERCURY ISOTOPES. V. FURTHER STUDIES ON THE REACTION OF $Hg^{202}6(^3P_1)$ ATOMS, PHOTOEXCITED IN NATURAL MERCURY VAPOR, WITH HYDROGEN CHLORIDE. J. R. McDowell, C. C. McDonald, and H. E. Gunning (Univ. of Alberta, Edmonton, Can.). Can. J. Chem. 37, 1432-41(1959) Sept.

A study was made of the reaction of $Hg^{202}6(^3P_1)$ atoms, in natural mercury vapor (Hg^N), with hydrogen chloride under flow conditions at room temperature. Emphasis was placed on the effect of reaction parameters and mercury-recovery techniques on the Hg^{202} content of the solid calomel formed in the reaction. For pure hydrogen chloride the Hg^{202} content of the Calomel was found to be 39.9 ± 0.3%, compared to the natural abundance of 29.8%. With 20 to 40 mole % of butadiene-1,3 in the hydrogen chloride, calomels containing 83 to 84% of Hg^{202} were consistently obtained. The Hg^{202} content of the calomel product was found to increase markedly when unsaturated hydrocarbons were added to the hydrogen chloride stream. The addends studied included butadiene-1,3, benzene, isoprene, acetylene, propylene, and ethylene in order of decreasing effectiveness. From steady-state calculations the effectiveness of the addend can be shown to be determined by the rate ratio, k_3/k_4. For the maximally enriching mixture of hydrogen chloride and butadiene, the effect of variations in lamp temperature and reaction pressure was studied. At lamp temperatures exceeding approximately 35°C, reduced enrichments were obtained owing to emission-line broadening. A progressive reduction in enrichment was also observed with substrate pressures greater than 25 mm, owing presumably to Lorentz-broadening of the hyperfine absorption contours of the Hg^N in the reaction cell. The Hg^{202} content of the calomel product was determined by resonance radiation absorbiometry. The apparent Hg^{202} abundances of the mercury recovered from the calomel product were found to depend strongly on the method used for isolating the enriched mercury from the calomel. Evidence was obtained for the occurrence of isotopically degradative exchange reactions during the recovery process. A recovery technique was developed which appeared to eliminate this exchange degradation. (auth)

23139

DETERMINATION OF THE CONTENT OF HEAVY WATER IN A MIXTURE OF HEAVY AND NORMAL WATER. Ales Fort (Karlovy Univ., Prague). (Czechoslov. J. Phys. 7, 740-4(1957). (Translated from Referat. Zhur. Fiz. No. 3, 1959, Abstract No. 5051.)

An interference method for determining the content of heavy water in a mixture of heavy and normal water is

described. This method can be applied to the control of the manufacture of heavy water.

23140

SEPARATION PARAMETER OF ISOTOPIC NITROGEN OXIDE ($N^{15}N^{14}O/N_2^{14}O$, N_2O^{18}/N_2O^{16}, $N^{15}O/N^{14}O$, AND $N^{15}O_2/N^{14}O_2$). W. Kuhn, A. Narten, and M. Thürkauf (Universität, Basel). Helv. Chim. Acta 42, 1433-6 (1959). (In German)

The separation parameters for the nitrogen oxide systems were determined by Rayleigh distillations of liquid substances with natural N^{15} and O^{18} content at atmospheric pressure. The isotopic analyses were made mass spectrographically. The measurements showed that the most probable δ values were $\delta_{N^{15}/N^{14}} = -(1.16 \pm 0.03) \times 10^{-3}$ for the $N^{15}N^{14}O/N_2^{14}O$ system, $\delta_{O^{18}/O^{16}} = -(1.8 \pm 0.2) \times 10^{-3}$ for the N_2O^{18}/N_2O^{16} system, $\delta_{N^{15}/N^{14}} = -(2 \pm 0.2) \times 10^{-2}$ for the $N^{15}O/N^{14}O$ system, and $\delta_{N^{15}/N^{14}} = -(2.75 \pm 0.03) \times 10^{-3}$ for the $N^{15}O_2/N^{14}O_2$ system. (J.S.R.)

23141

AUTOMATIC CASCADE FOR THE PRODUCTION OF NITROGEN-15. G. M. Begun, J. S. Drury, and E. F. Joseph (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 51, 1035-8(1959) Sept.

A small automatic isotope separation cascade was constructed and operated to evaluate the use of the HNO_3-NO chemical exchange reaction as a method of separating nitrogen-15 on a large-scale basis. Successful operation of the cascade over a long period of time demonstrated the technical feasibility of the chemical process and the cascade design. The most sensitive technical scale-up problem was found to be the design of the nitric acid refluxers. The most important economic factor was the favorable disposition of large quantities of by-product sulfuric acid. (auth)

23142

ON THE COMPUTATION OF CASCADES SERVING FOR THE SEPARATION OF STABLE ISOTOPES. V. K. Turkin. Nauch. Doklady Vysshei Shkoly. Khim. i Khim. Tekhnol., No. 2, 385-7(1958).

A cascade for separating stable isotopes is examined. Formulas are presented for cases in which waste material is processed for the second time. Also formulas to express the interdependence between the concentration and the current were derived. (J.R.D.)

23143

AN ELECTROMAGNETIC LABORATORY SEPARATOR. O. V. Shcherbak. U.S.S.R. Patent 113740. Byull. Izobret., 1958, No. 6.

An electromagnetic separator for laboratory use, with rotating magnets, featuring magnetic elements in the form of wedge prongs placed on the end walls of the rotating magnets, and with a helix between the magnets provided with apertures for input material and discharge of the magnetic and non-magnetic fractions is discussed. The design prevents non-magnetic grains from getting into the magnetic fraction. (TCO)

TECHNOLOGY

Feed Materials

23144 NP-7921

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

SOLVENT EXTRACTION STUDIES. MAGNESIA SLURRY STRIPPING OF TRI(ISO-OCTYL) AMINE URANIUM EXTRACTS. A. Bellingham and R. Simard. Mar. 27, 1957. 12p. (TR-141/57).

Attempts to operate a simple magnesia-slurry stripping system with tri(iso-octyl) amine extractant have not been completely successful although the results have shown more promise than the secondary amine tested previously. The present results show a satisfactory strip of the uranium with approximately 95% reporting in the aqueous phase and the remainder at the interface. The build-up of this material presents a problem as does also the formation of a non-settling liquid-liquid foam. Magnesia usage is approximately 0.8 lb/lb U_3O_8 and organic losses in the precipitate run between 0.1 and 0.3 lb/lb U_3O_8. Some required changes to the circuit are now evident and improved results are anticipated. The use of additives (other than the usual alcohol) in the organic phase has not shown very much promise in preliminary testing. (auth)

23145 NP-7922

Canada. Dept. of Mines and Technical Surveys. Mines Branch.

THE RADIATION LABORATORY OF THE MINES BRANCH—1947–1959. G. G. Eichholz. Apr. 1, 1959. 56p. Mines Branch Information Circular IC-113. $0.25.

A general review of activities of the Radiation Laboratory Section of the Radioactivity Division during the years 1947–1959 is presented. This includes descriptions of major projects in uranium and thorium assaying, counter development, circuit design, as well as various applications of radioactive isotopes as tracers in extractive and physical metallurgy. A complete bibliography of papers and reports is appended. (auth)

23146 TID-3081

Technical Information Service, AEC.

FEED MATERIALS. PART I. URANIUM ORE CONCENTRATE REFINING, URANIUM TETRAFLUORIDE PRODUCTION, AND SCRAP RECOVERY. A BIBLIOGRAPHY OF CLASSIFIED REPORT LITERATURE. Gifford A. Young, comp. Nov. 1955. Decl. Aug. 12, 1959. 95p. $13.80(ph), $4.80(mf) OTS

Selected reports on technical aspects of feed material production are annotated. Scope includes the refining of U ore concentrates or high-grade ores to provide purified $UO_2(NO_3)_2 \cdot 6H_2O$ and conversion of the latter to UF_4 by thermal denitration to UO_3, followed by reduction to UO_2 and hydrofluorination to UF_4. Reports on possible alternative processes as well as on recovery of U from various scraps and waste residues also are abstracted. In particular, purification of concentrates by direct fluorination to UF_6 and distillation of the latter is covered. Reports on recovery of HNO_3, HF, and solvent also are abstracted. Handling of U compounds of normal isotopic content only is considered. The annotations are grouped by subject, and author and report-number indexes are included. A glossary of codes used in feed materials technology is appended. A total of 495 annotations are provided for 450 reports. (auth)

Raw Materials

23147 WIN-115

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

SUMMARY REPORT, 1954-1959 RAW MATERIALS DE-

VELOPMENT LABORATORY WINCHESTER, MASSACHUSETTS AND GRAND JUNCTION, COLORADO. R. G. Beverly, ed. Sept. 30, 1959. Contract AT(49-6)-924. 94p. $2.25(OTS).

A brief review of the research work performed by the National Lead Company on the recovery of U from its ores is presented. A bibliography is presented which includes all reports on raw materials published by National Lead Company through Dec. 1958. Also included is a list of complete publications on raw materials from 1944 to 1954. (W.L.H.)

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